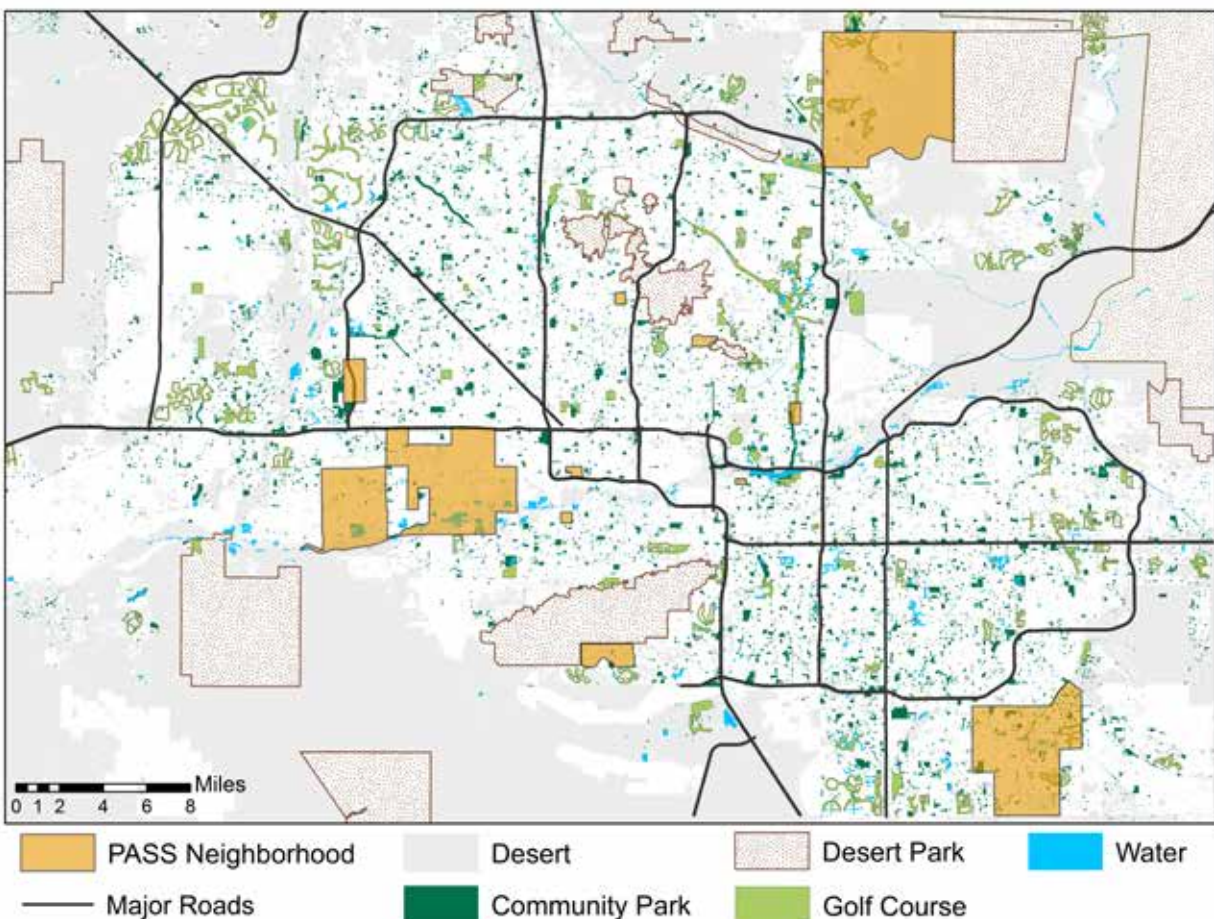


THE PHOENIX AREA SOCIAL SURVEY IV

LINKING SOCIAL AND BIOPHYSICAL DYNAMICS IN URBAN NEIGHBORHOODS



2017 REPORT

THE PHOENIX AREA SOCIAL SURVEY IV

LINKING SOCIAL AND BIOPHYSICAL DYNAMICS IN URBAN NEIGHBORHOODS

Kelli L. Larson

kelli.larson@asu.edu

School of Geographical Sciences and Urban Planning
School of Sustainability

Riley Andrade

rileyandrade@asu.edu

School of Geographical Sciences and Urban Planning

Abigail York

Abigail.York@asu.edu

School of Human Evolution and Social Change

Other Contributors:

Dan Childers, Paul Coseo, Stevan Earl, Meagan Ehlenz, Nancy Grimm, Sharon Hall, Sharon Harlan, David Hondula, Susannah Lerman, Deidre Pfeiffer, Julie Ripplinger, Kerry Smith, Paige Warren, Mark Watkins, Dave White, Sally Wittlinger, Mary Wright, Amber Wutich

This material is based upon work supported by the National Science Foundation under grant number, DEB-1637590, Central Arizona–Phoenix Long-Term Ecological Research (CAP LTER).

TABLE OF CONTENTS

Overview of the Phoenix Area Social Survey IV	4
Investigating Urban Ecology and Infrastructure	4
Biophysical Data Linked to Surveyed Neighborhoods	5
The Ecological Survey of Central Arizona (ESCA).....	5
Ecological Sampling Beyond ESCA.....	6
Additional Data for Social-Ecological Analyses.....	7
Integrated Social-Ecological Research	7
Human-Wildlife Interactions.....	7
Heat Stress and Adaptation.....	8
Sampling Design: PASS IV	8
The 2017 Sample.....	8
Survey Administration	10
Incentives and the Methodological Experiment.....	10
Response Rates.....	10
Sample Demographics.....	11
Constructs and Variables	11
Quality of Life and Personal Satisfaction	12
Place Attitudes and Park Visitation	12
Ecosystem Services and Wildlife Perceptions.....	13
Risk Perceptions and Practices	14
Residential Landscaping Decisions	14
Demographics and Other Constructs	15
Overview of Study Neighborhoods	16
Parcel Characteristics	16
Neighborhood Demographics	17
Neighborhood Profiles	18
Neighborhood AA9	18
Neighborhood 711.....	20
Neighborhood IBW.....	22
Neighborhood PWR	24
Neighborhood Q15	26
Neighborhood TRS	28
Neighborhood R18.....	30
Neighborhood U18.....	32
Neighborhood U21.....	34
Neighborhood V14	36
Neighborhood W15	38
Neighborhood X17	40
Conclusion	42
Works Cited	43

OVERVIEW OF THE PHOENIX AREA SOCIAL SURVEY IV

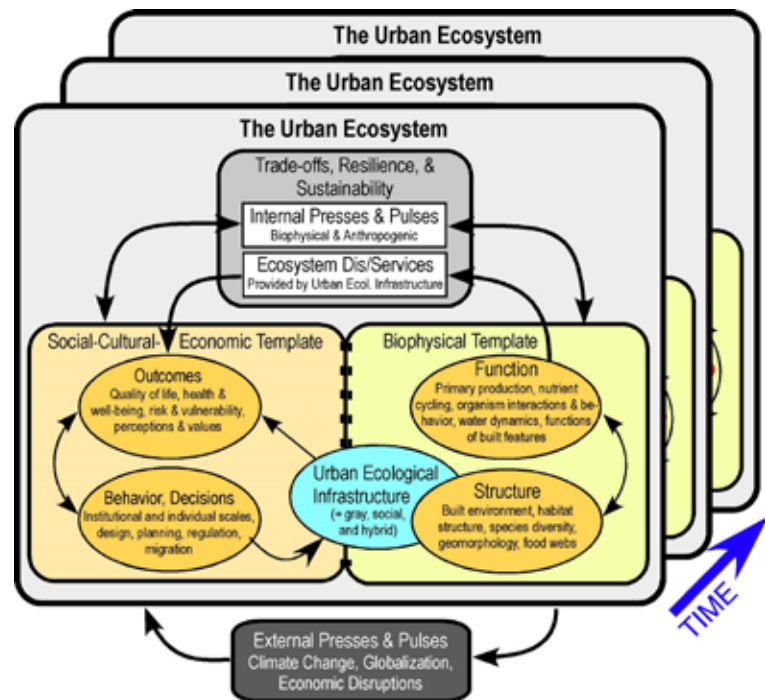
The [Phoenix Area Social Survey](#) (PASS) was established in 2001 as part of the Central Arizona–Phoenix Long-Term Ecological Research (CAP LTER) project’s long-term monitoring program. Every five years, the PASS team surveys households in select neighborhoods in Metropolitan Phoenix in order to better understand people’s perceptions, attitudes, and behaviors on environmental issues such as heat stress and climate change, water scarcity and policy, landscape choices and management, and urban wildlife and biodiversity. In 2001, the first PASS was piloted in 8 neighborhoods (n= 302) in the City of Phoenix, Arizona.

Aiming for about 20 respondents per neighborhood, the 2006 (n= 808) and 2011 (n= 806) samples were expanded to cover a broader range of neighborhoods (40–45) that better represent the geography of the greater metropolitan area, both in terms of location and demographics. In order to characterize and examine residents’ views and practices in particular Phoenix-area neighborhoods, the 2017 survey was redesigned to target a larger number of people (~65) in fewer (12) neighborhoods across the region. The new sampling design allows for intensive neighborhood analyses that link residents’ perceptions, attitudes, and decisions to the local ecology (e.g., urban infrastructure, landscape attributes, species composition; see CAP IV conceptual framework).

As described further below, the 2017 PASS neighborhoods were distributed across CAP LTER ecological monitoring sites at green/blue infrastructure such as the Salt River, Tempe Town Lake, and Indian Bend Wash, in addition to desert preserves such as South Mountain Park and McDowell Sonoran Preserve. Ecological data also collected at these sites included climate and temperature data, nutrient fluxes, and wildlife community measurements. In each neighborhood, for example, the local bird community was measured at three point-count stations so that we can link biodiversity metrics to people’s views and actions that affect them. Overall, the 2017 PASS survey will explore major themes integral for understanding social-ecological system dynamics including urban ecosystem services, environmental satisfaction and perceptions, and vulnerability and adaptation to various urban ecological risks.

INVESTIGATING URBAN ECOLOGY AND INFRASTRUCTURE IN METROPOLITAN PHOENIX, ARIZONA

The 2017 PASS survey was redesigned partly to answer the following research question: *How do the services provided by dynamic urban ecosystems and their infrastructure affect human outcomes and behavior, and how do human actions affect patterns of urban ecosystem structure and function, and ultimately, urban sustainability and resilience?* This is the central question guiding the latest round of CAP (IV): 2016-22. The next survey is tentatively planned for 2022 and will follow the same design to facilitate longitudinal analysis of temporal trends and social-ecological dynamics across the Phoenix region. As can be



The CAPIV conceptual model illustrates our understanding of urban socio-ecological systems. As seen in the diagram, recent CAP research focuses on urban infrastructure as a bridge between biophysical and human/social components of the system.

seen from the 2016 conceptual framework, we envision urban infrastructure – including grey (human), green (vegetation), blue (aquatic), turquoise (riparian and wetland), and brown (desert and mountain parks) – as a physical link between the human (left) and ecological (right) sub-systems.

BIOPHYSICAL DATA LINKED TO SURVEYED NEIGHBORHOODS

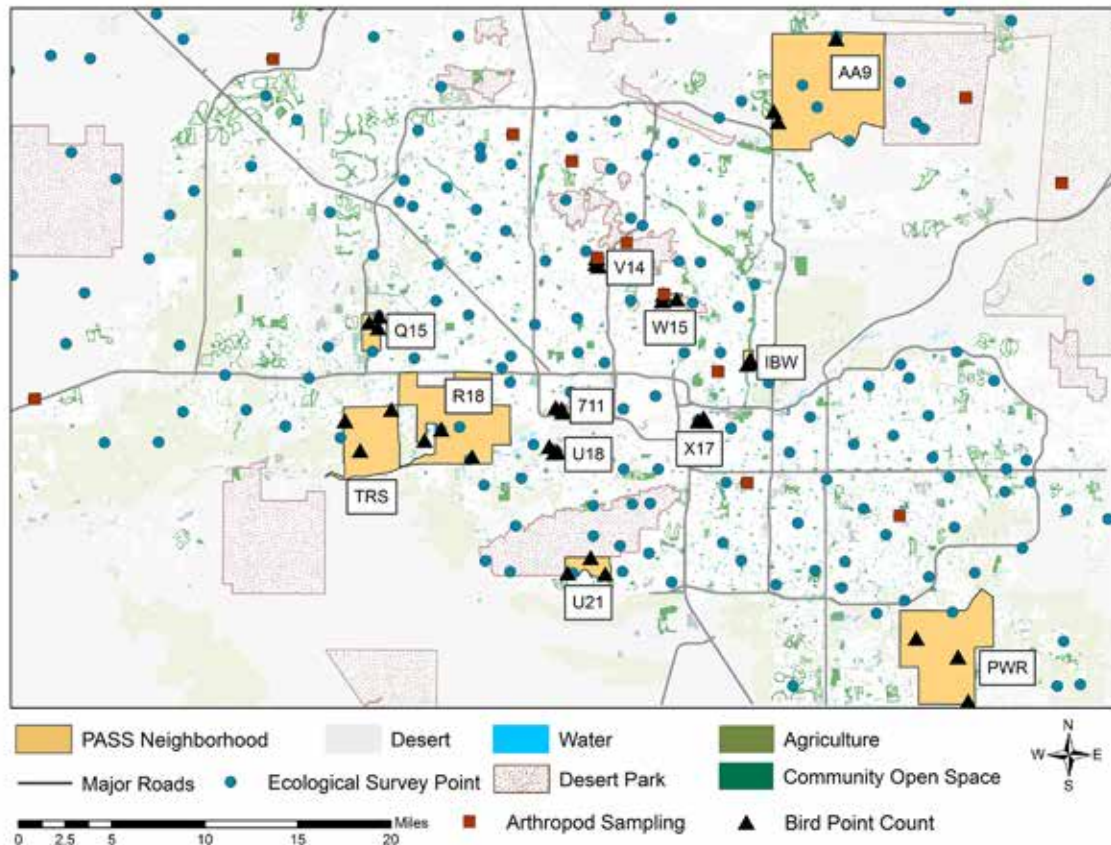
The Ecological Survey of Central Arizona

The PASS study neighborhoods have always been and continue to be co-located with long-term ecological monitoring efforts formerly called Survey 200 and renamed the [Ecological Survey of Central Arizona](#) (ESCA) in 2016. Conducted every five years since 2000, the ESCA is an extensive longitudinal field survey designed to characterize key ecological indicators of the CAP LTER study area. The survey is conducted at approximately 200 sample plots (30x30 meters) that were located randomly using a tessellation-stratified dual-density sampling design.

The design is intended to capture the diverse habitats encapsulated by the CAP LTER study area, ranging from native Sonoran desert to developed parcels with varying land use and cover characteristics. Major objectives are to characterize patches in terms of key biotic, physical, and chemical variables; and to examine relationships among land use, general plant diversity, native plant diversity, plant biovolume, soil nutrient status, and social-economic indices along indirect urban gradients. Specific field measurements include an inventory of the following:

- **annual and perennial plants** identified to the lowest possible taxonomic unit, typically species
- **plant size measurements** including the estimated plot cover of annuals and the biovolume of all trees and shrubs
- **physicochemical properties from soil** coring such as extractable ammonium, nitrate, and phosphorous; total, organic, and inorganic carbon; organic matter; pH and conductance, along with bulk density and texture
- **insects** from sweep-net sampling, including enumerations and identification to lowest practical taxonomic unit
- **general assessment of plots** including indicators of human activities, landscapes types and level of maintenance, nearby transportation infrastructure, and other neighborhood conditions
- **photos** of plants, plots, and surrounding environs

To better represent residential areas, the ESCA sampling protocol was expanded in 2010 to include surveys of one entire parcel (front and backyard) coinciding with each 30x30 m plot situated in single-family residential areas. In many cases, the 30x30 m plots include sections of more than one parcel. If this is the case, attempts are made to survey the parcel containing the greatest percentage of the 30x30 m plot, but this is not always possible.



The location of various ecological sampling points are displayed above in relation to the 2017 PASS study neighborhoods.

Ecological Sampling Beyond ESCA

Additional long-term monitoring programs focus on ground-dwelling arthropods and bird censuses, and coincide with some of the ESCA study plots but have been collected at more frequent intervals than every five years. Specifically, ground-dwelling arthropods – collected with pitfall traps – have been enumerated and identified quarterly since 2000 in five¹ of twelve PASS IV neighborhoods: V14, W15, R18, Q15, and TRS. Arthropod samples were last collected at site R18 in July 2012, and at Q15 and TRS in October 2016. Neighborhoods V14 and W15 maintain active pitfall sites. Other pitfall sites are located outside of the PASS IV neighborhoods, most of which coincide with ESCA study plots.

At the time of the PASS III in 2011, bird census data were only collected at one point in each PASS neighborhood. In 2017, this number was increased such that each of the twelve PASS neighborhoods contained three bird census points. Eight of the twelve neighborhoods retained the previous bird point (associated with an ESCA plot) with two other points added, while the remaining four neighborhoods (711, IBW, PWR, and TRS) had three bird points added for 2017. Other bird points are located at ESCA sites outside of the PASS IV neighborhoods.

In 2016-17, CAP LTER decided to modify the PASS survey and several long-term ecological monitoring programs to enhance the integration of the project’s ecological and social datasets. For the 2017 PASS, this meant seeking a larger number of respondents in fewer neighborhoods for more intensive social-ecological

¹In one case, the sampling point is located about 100 yards outside of the neighborhood boundary.

analyses. Fewer neighborhoods allow for more intensive ecological sampling at each location, and CAP LTER has already increased the number of bird census locations in PASS neighborhoods (census above). Beginning in 2020, the ecological and social surveys will be further refined to achieve an even tighter coupling between these efforts by sampling three ESCA plots in each PASS neighborhood.

Additional Data for Integrated Social-Ecological Analyses

Beyond the PASS and ESCA data, a number of other datasets could be combined with these primary long-term data sets for analysis of social-ecological dynamics in Metropolitan Phoenix. Some of these datasets include: assorted demographic variables from the U.S. Census, parcel attributes from local tax assessor datasets, and a myriad of parameters from remotely-sensed data (e.g., vegetation data from the Normalized Difference Vegetation Index (NDVI)) or Soil-Adjusted Vegetation Index (SAVI) for select years. The CAP LTER's land use/cover datasets also offer much potential for integrated analysis with the core social and ecological datasets. These include expert-based classifications from Landsat imagery (30-meter resolution) for 2000 and 2010 as well as classifications from the National Agricultural Imagery Program (NAIP; 1-meter resolution) for 2010 and 2015 (which is underway).

With the focus on urban infrastructure now and into the future of CAP LTER, aerial imagery and other datasets that provide information on the location and type of such infrastructure is also an avenue for further research. One example here is a study by Hale et al. (2015), which linked stormwater infrastructure in the region to water quality measures such as nutrient loads. In this work, data were obtained from the City of Scottsdale for the four types of stormwater infrastructure used in the region: stormwater drainage pipes, engineered channels, natural washes, and retention basins. This study found that from 1955 to 2010 stormwater infrastructure shifted from underground pipes to linear channels (engineered channels typically with paved materials, gravel, or grass) and retention basins (engineered depressions with various landscaping types) to natural washes (more natural channels that function more like relict ephemeral streams in sand or gravel beds). Moreover, the density of retention basis decreased runoff while imperviousness increased runoff, leading to higher levels of nutrients and dissolved organic carbon.

INTEGRATED SOCIAL-ECOLOGICAL RESEARCH

Some CAP LTER research has linked the ESCA, PASS and still other datasets for integrated social-ecological analyses. The two research areas where this has been done most successfully pertain to 1) human-wildlife interactions, and 2) heat stress and adaptation.

Human-Wildlife Interactions

CAP LTER ecologists and social scientists have integrated species composition and biodiversity data – especially on bird and arthropod communities – with human variables from the PASS datasets.

Birds, People, and Landscaping

Residents' satisfaction with local bird populations have been linked to the community composition of bird species in surveyed neighborhoods. Using 2006 data, Lerman and Warren (2011) found that people's satisfaction was positively associated with actual bird diversity. More recently, the same variables were analyzed by Warren et al. (in progress) for 2011, along with parcel-level reported landscape types (xeric, oasis, mesic) from the PASS data. The results indicate that the number of people satisfied with bird variety in their neighborhood as well as actual bird richness and bird occupancy all decreased between 2006 and 2011. Moreover, bird species and landscaping trends persisted between the two time periods; namely, desert specialists increased in abundance in neighborhoods with desert-like, xeric landscaping, while invasive and generalist species increased in abundance in neighborhoods landscaped with grass-dominated, mesic landscapes.

Arthropods, Residential Landscapes

The 2006 and 2011 survey data on reported landscape types was also linked to the arthropod data in Phoenix area neighborhoods, along with perceptions about yard maintenance (i.e., weediness) during the recession. Preliminary results indicate that arthropod diversity and abundance decreased after the Great Recession while shifting toward species associated with weediness. In addition, grass cover was negatively related to richness and abundance in residential yards, whereas foreclosure rates are positively related to arthropod diversity. Moreover, precipitation becomes a more significant driver after the recession due to a lack of irrigation. Overall, residents' preferred a mesic (lawn) aesthetic even though this type of landscape might lead to a homogenized arthropod community.

Heat Stress and Adaptation

To understand heat vulnerability in Metropolitan Phoenix, transdisciplinary scholars have integrated climatological and biophysical datasets with survey data that measure perceptions of local (neighborhood) temperatures and experience of heat stress symptoms.

Heat Vulnerability and Access to Cooling Resources

Combining survey data from the 2001 PASS with meteorological and remote sensing data measuring temperatures and land use/cover configurations, Harlan et al. (2006) demonstrated that neighborhoods with lower socioeconomic status and more ethnic minorities were likely to be warmer due to lower vegetation density, higher settlement density, and a lack of green space. These variables and, thus, environmental heat and exposure to heat stress varied significantly across the urban environment and were not necessarily related to distance from the urban core. In addition to living in warmer neighborhoods, populations who are more vulnerable to heat stress also lack access to critical heat mitigation and adaptation strategies (such as air conditioning and swimming pools), compounding the impact of heat on human health in these neighborhoods.

Experience with Heat Stress

PASS 2006 and 2011 data support the findings of Harlan et al. (2006) that indicate impoverished populations are more likely to live in warmer neighborhoods with lower vegetation density. Ruddell et al. (2009) and Jenerette et al. (2016) further found that self-reported experience with and frequency of heat-related illness were positively correlated with air temperature and land surface temperature. Moreover, the effect of daytime surface temperature on frequency of heat illness is greater for people with lower access to air conditioning in their homes (Jenerette et al. 2016).

Neighborhood-Level Perceptions of Heat

In the 2006 and 2011 PASS, residents were asked about their perceptions of local temperatures and land cover in their own neighborhoods compared to other neighborhoods. The survey responses from the 2006 and 2011 PASS accurately reflect the observed land surface temperature and vegetation density (Jenerette et al. 2016) as well as modeled air temperature differences between PASS neighborhoods (Ruddell et al. 2009, Ruddell et al. 2012), supporting the validity of citizen perception of neighborhood temperature and land-cover comparisons.

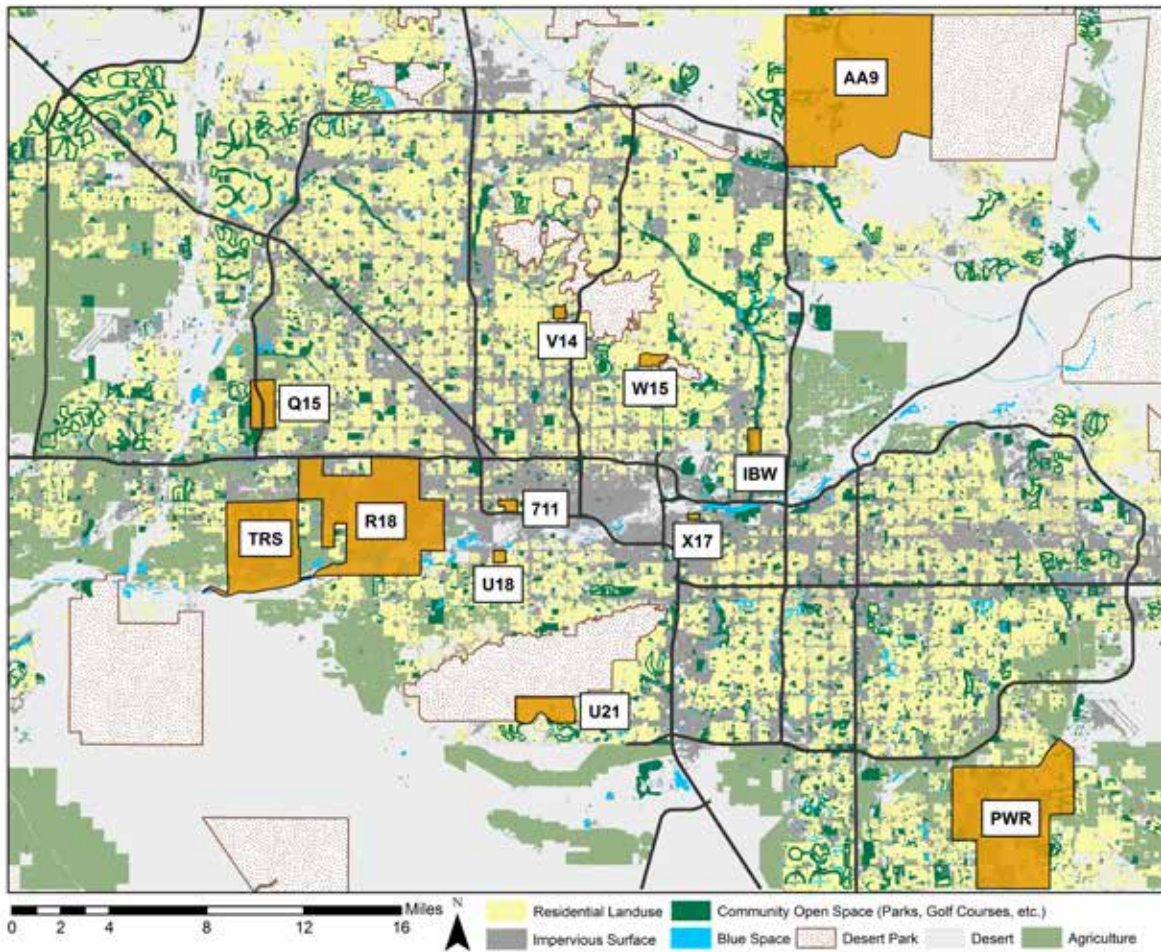
SAMPLING DESIGN: PASS IV

The 2017 Sample

The Phoenix Area Social Survey (PASS) was redesigned in 2017 to allow for integrated analyses of social-ecological systems. The new survey aims to sample more people (approximately 65) in a smaller number of targeted neighborhoods (12). In contrast, the previous sampling strategy (for 2006 and 2011) involved

selecting fewer people (approximately 20) across more neighborhoods (40-45). In all versions, census block groups defined the spatial extent of the neighborhoods.

The neighborhoods surveyed in 2017 were purposively selected to span income levels and locations across the metropolitan region, in addition to capturing areas with varied ethnic profiles and time of development. Ten neighborhoods were selected from the 2011 neighborhoods, while two neighborhoods were added to capture areas in proximity of green infrastructure where ecological research is ongoing. The new neighborhoods were Indian Bend Wash (IBW) and Tres Rios Wetlands (TRS).



Map of the 12 neighborhoods surveyed in relation to land use/land cover in Phoenix, Arizona

The total sample of addresses invited to participate in PASS included 1,400 residents. This sampling frame includes 188 addresses provided from former PASS respondents (from the 2011 survey) and 1,212 other addresses provided by the Marketing Systems Group (MSG). The MSG addresses come from U.S. Postal Service's (USPS) Delivery Sequence Files, which provide a high-coverage list that includes all mailable USPS addresses. For the MSG sample, addresses were randomly selected across the 12 neighborhoods using the census block groups of the neighborhood; 101 new addresses were selected per neighborhood, though 115 addresses were randomly drawn to have back-up addresses, if needed, to replace duplicates with the previous sample or bad addresses.

Summary matrix of the 12 PASS neighborhoods surveyed in the summer of 2017

ID	Location	Nearby Infrastructure Land Use Context	Avg. Year Developed	Median Per Capita Income	Percent Non-White
AA9	Fringe: Scottsdale (NE)	McDowell Sonoran Preserve	2000	\$88,000	14%
711	Core: Phoenix	Downtown Phoenix (city core)	1971	\$11,000	85%
IBW*	Suburban: Scottsdale (E)	Indian Bend Wash	1974	\$41,000	18%
PWR	Fringe: Gilbert (SE)	Agricultural	2007	\$33,000	26%
Q15	Suburban: Phoenix (W)	Agricultural	2001	\$22,000	76%
R18	Suburban: Phoenix (SW)	Salt River (unmanaged section)	2003	\$15,000	88%
TRS*	Fringe: Phoenix (SW)	Salt River (Tres Rios Wetlands)	2006	\$18,000	83%
U18	Core: Phoenix	Salt River (Audubon)	1953	\$12,000	95%
U21	Fringe: Phoenix (S)	South Mountain Preserve	1995	\$54,000	24%
V14	Core: Phoenix	Phoenix Mountain Preserve	1981	\$32,000	29%
W15	Core: Phoenix	Camelback Mountain	1968	\$73,000	12%
X17	Core: Tempe	Salt River (Tempe Town Lake)	1982	\$24,000	50%

*Neighborhoods newly added in 2017; all others were surveyed in previous versions of PASS

Survey Administration

The University of Wisconsin Survey Center administered the survey from early June through mid-August of 2017. Surveys were delivered by mail only, where addresses were randomly selected from the census block groups of each neighborhood. The PASS survey was mailed in a wave data collection design. The first wave included the survey, a postage-paid card to request a Spanish copy of the survey (which was translated and back-translated according to the requirements of ASU's Institutional Review Board), and a return envelope. This was followed by three additional mailings. The second mailing involved a reminder postcard sent to all sampled households. The third and fourth waves included the full packet sent to addresses that had not previously returned the survey. The survey mailings were sent out on May 31, June 6, 2017 (postcard), June 22, and July 18 during the summer of 2017. Data collection ended on September 15.

Incentives and the Methodological Experiment

Pre- and post- incentives were provided to participants to increase response rate. The initial survey packet included a pre-incentive of \$5 for each respondent. Additionally, an experimental design was implemented to test which incentives – varied by dollar amounts and whether individuals receive the money themselves or donate the money to particular charities – are most effective in recruiting survey participants. For this purpose, addresses were randomly assigned to one of fifteen post-incentive groups, which include \$5, \$25, and \$40 rewards to either the participant or to one of the following charities: St. Mary's Foodbank, Phoenix Children's Hospital, Desert Foothills Land Trust, or participant's choice of charity.

Response Rates

The overall response rate for the 1,400 sampled households was 39.4%, yielding a sample of 496. This rate is based on the American Association for Public Opinion Research's Response Rate 2, which is calculated as the number of completed and partial questionnaires divided by the total N minus both vacant and undeliverable addresses. At the neighborhood level, the response rates varied from a low of 22.2% in one of the lowest income areas (711) to a high of 55.6% for a middle-income agricultural fringe area (PWR).

Sampling Details and Response Rates across the Twelve Study Neighborhood

	711	AA9	IBW	PWR	Q15	R18	TRS	U18	U21	V14	W15	X17	All Nbhds.
Sampled addresses	113	114	101	121	122	121	101	122	121	122	121	121	1400
Fully/partly completed (n)	22	46	37	60	39	28	29	34	56	50	56	39	496
Refusals	0	3	1	0	0	0	0	0	1	1	1	0	7
Returned as undeliverable	7	12	12	9	1	4	4	0	5	3	5	8	70
Returned as vacant address	7	6	0	4	3	6	3	1	3	15	6	16	70
Response rates (%)	22.2	47.9	41.6	55.6	33.1	25.2	30.9	28.1	49.6	48.1	50.9	40.2	39.37%

Note, one survey was not included in the calculation of the response rate since the respondent removed the identification number before returning the survey, and thus, we do not know the parcel or neighborhood from which the survey came. In the dataset, the case ID for this respondent is noted as 80000. This missing case ID means the total respondents equaled 497, rather than the 496 noted above.

Sample Demographics

The survey respondents were, on average, 51 years of age with household incomes around \$80,000-\$100,000, which is fairly representative of the study neighborhoods. The sample was relatively educated, with 29% holding a bachelor's degree and another 26.7% a graduate degree. While approximately two-thirds were white, one-fifth were Mexican or Latino.

CONSTRUCTS AND VARIABLES

The content of PASS addresses a variety of urban environmental issues as well as some basic social science constructs and demographics that are important predictors or context for understanding social-ecological dynamics in cities. Where possible, we have adopted (verbatim) or adapted (with some modifications) established survey questions that have been shown to form reliable composite scales for certain phenomena. In other cases, we conceptualized and operationalized survey constructs and associated questions based on relevant scholarly literature. While some questions have been asked across time periods for longitudinal analysis, others have been adopted based on the current research questions and interests among investigators with CAP LTER. Below, we outline the constructs evaluated and the survey questions used to evaluate them.

Quality of Life and Personal Satisfaction

Overall Quality of Life
Life Satisfaction
Environmental Satisfaction
Access to Services

Place Attitudes and Park Visitation

Place Identity
Desert Attitudes
Outdoor Recreation

Residential Landscaping Decisions

Landscaping Choices
Yard-Management Practices
Changes to Parcel Infrastructure

Demographics and other Constructs

Environmental and Political Value Orientations
Demographics and Housing/Household Characteristics
Length of Residency and Place of Origin

Ecosystem Services and Wildlife Perceptions

Ecosystem Dis/Services
Human Wildlife Problems
Evaluations of Neighborhood Birds

Risk Perceptions and Practices

Environmental Problems
Heat Perceptions and Practices
Water Resources and Flooding

Quality of Life and Personal Satisfaction

Several questions on the survey were incorporated to evaluate people's attitudinal evaluations of their lives. More specifically, quality of life (QoL) is a multidimensional construct that captures how people assess – either positively or negatively – varying aspects of their life (e.g., health, work, etc.) (The WHOQOL Group 1998). We focused on overall quality of life and assorted measures of life satisfaction, as described below.

- **Overall Quality of Life:** Included in PASS since 2006, two questions (Q1 & 2) were asked to assess residents' overarching views about the "quality of life" in the Valley. The first asked the survey respondents to rate the present QoL in the Phoenix metro area, from "not at all good" (1) to "very good" (4), and a second asked if people anticipate that the future – "over the next 10 years" – will stay the same or get a little or much better or worse.
- **Life Satisfaction:** In 2017, the well-cited scale – developed and proven reliable by Diener et al. (1985) – was added to the survey. This scale – aimed at people's subjective evaluation of their own lives – includes five statements (e.g., "In most ways my life is close to my ideal." "The conditions of my life are excellent.") that were assessed on a five-point response scale ranging from "strongly disagree" to "strongly agree" (Q68).² These items could be analyzed separately; however, as an overall measure of life satisfaction, we recommend averaging the individual responses to create a composite scale of life satisfaction.
- **Environmental Satisfaction:** Questions have been asked in previous versions of PASS to assess residents' dis/satisfaction with various aspects of their neighborhood. While previous questions in 2006 and 2011 focused on an array of local attributes (e.g., safety, crime), we modified the 2017 question (Q9) to focus almost entirely on environmental attributes (e.g., the amount of trees and parks, flowering and desert plants) of neighborhoods. The one exception was the inclusion of "the quality of housing." For all of these items, a five-point response scale ranged from "strongly dissatisfied" to "strongly satisfied" with a "neither" option in-between.
- **Access to Services:** Drawn from Sallis' (2017) Neighborhood Quality of Life Survey, we included a four-item question (Q10) to assess residents' access to local amenities including 1) grocery stores, 2) stores within walking distances, 3) other places to go within walking distance, and 4) walkability to transit stops. The five-point dis/agree response scale was used for this question.

Place Attitudes and Park Visitation

In the 2017 survey, a series of questions gauged residents' personal connections with varied places in the study region including their local neighborhoods, the desert environment, and open spaces like parks and areas with rivers or lakes. Some but not all these questions were included in previous versions of PASS.

- **Place Identity:** Place attachment (PA) is a multi-dimensional construct commonly evaluated using a survey scale developed by William and Vaske (2003). The three dimensions of PA include place identity, place dependence, and social bonding. Since CAP LTER investigators are most interested in residents' emotional bonding to where they live, we evaluated place identity with newly added items to the 2017 survey.

²Note, all questions with dis/agree response scales included a five-point response scale including "strongly disagree," "disagree," "neutral," "agree," and "strongly agree."

Specifically focusing on two different scales – residents' neighborhoods (Q11) and the region's desert parks (Q4), we adapted five of the six standard statements³ for each 'place.' Evaluated on a five-point dis/agree response scale, example statements include: "My neighborhood means a lot to me," and "The desert parks in the Valley are very special to me."

- **Desert Attitudes:** Beyond measuring identification with desert parks, we included five statements – again using a five-point dis/agree scale – to capture attitudes toward the desert (Q7). Two of these statements – "The desert is an empty wasteland," and "The desert is very special to me" – were repeated from the 2006 and 2011 surveys (Andrade et al. 2017), while three more were newly added in 2017 based on written comments from previous survey respondents as well as common literary descriptions of the desert. Since the statements included positive (3 variables) and negative (2 variables) wording, the latter (i.e., the desert is a wasteland, and the desert should be developed) can be reverse coded to create a composite scale of attitudes toward the desert by averaging the five items, such that (1) represents the most negative attitudes and (5) the most positive.
- **Outdoor Recreation:** A set of new questions were developed for the 2017 PASS that gauge the frequency at which residents visit particular types of parks or outdoor areas, both in the "summer months of June, July, and August" (Q5) as well as the "other, non-summer months" (Q6). With a five-point response scale ranging from "never" to "at least once per week," we asked this question for desert parks and neighborhood parks as well as streams, ponds and lakes both within and outside of the metropolitan area.

Ecosystem Services and Wildlife Perceptions

The 2017 PASS included several questions to evaluate people's perceptions of ecological functions and urban wildlife, with special attention to a range of ecosystem services and disservices as well as local bird and arthropod communities, all of which are central to CAP LTER's ecological research. The majority of these data were not collected in previous versions of PASS.

- **Ecosystem Dis/Services:** Largely based on the work of Larson et al. (2016) and Brown et al. (2016), we developed a multi-item survey question to gauge residents' perceptions of the degree to which the environment in their neighborhood provides particular ecosystem services (amenities or benefits) and disservices (dis-amenities or problems). In referencing "the environment," we specified consideration of "the grass, plants, and/or trees in the area, along with the streets, sidewalks, patios, porches and built structures as well as parks and open spaces" (Q16-17). With a five-point dis/agree response scale, we asked about several ecosystem dis/services (17 items total). The inclusion of disservices – as opposed to only beneficial services – is unique relative to past approaches, as is our focus on urban ecosystems in the form of local neighborhood environments.
- **Human-Wildlife Problems:** A set of questions (Q45-46) was newly created in 2017 to ascertain if residents view different types of wildlife as problematic (or not), with a five-point response scale ranging from "not a problem" to "a very big problem." The wildlife asked about included the following arthropods: insects, ants, scorpions, bees, black widow spider, cockroaches, mosquitoes, and termites. We also inquired about mammals: birds, coyotes, javelinas, rats, snakes, and stray pets. Lastly, we evaluated attitudes toward pollinators (Q44) by asking the extent to which residents "like" or "dislike" (using a five-point scale) the following: bats, bees, butterflies, and hummingbirds.

³The statement about "visiting" places was omitted since this item is most relevant to tourism research, which is not central to CAP LTER.

- **Neighborhood Birds:** Drawing on a handful of previous surveys (Belaire et al. 2015; Clergies et al. 2001; Clucas et al. 2012; Cox and Gaston 2015; Lerman and Warren 2011), we developed new questions regarding birds at the local scale of people's neighborhoods for the 2017 survey. First, we asked how residents perceive birds in their neighborhood with a response scale ranging from "not at all" (1) to "extremely" (5). This question (Q41) reflects attitudinal evaluations of local bird populations in that respondents rated birds based on positive traits (e.g., colorful, easy to watch, unique to desert, pleasant noises) and negative ones (e.g., unpleasant noises, diseases, messes, eating vegetation). Second, residents were asked (Q42) about whether or not they attract birds to their yards through various means (e.g., putting out food or water, planting vegetation, maintaining bird houses).

Risk Perceptions and Practices

In addition to asking about urban wildlife risks, survey questions asked residents to rate the seriousness of other environmental risks. Linked to research on urban climate and water resources, we specifically focused on heat stress, mitigation, and adaptation as well as flood risks and their management.

- **Environmental Problems:** A question from the 2011 PASS was adopted (with some modifications) in 2017 to examine residents' perceptions about a variety of environmental risks (Q47). In particular, on a five-point scale ranging from "not at all serious" to "extremely serious," survey respondents rated the following risks: air pollution, global warming and climate change, extreme heat, normal summer temperatures, severe storms, floods, drought, water shortages, water pollution, and drinking water safety. Many of these items were included in previous versions of the survey, though some were slightly reworded.
- **Heat Perceptions and Practices:** Several questions evaluated perceptions and practices regarding heat stress, adaptation, and mitigation, as analyzed in work by Harlan and colleagues (Harlan et al. 2006; Ruddell et al. 2009, 2012; Jenerette et al. 2016). Risk perceptions were gauged by asking residents (on five-point scales) if they think their neighborhood is relatively hot, cool, or about the same as others in the region (Q18), in addition to asking about the mechanisms (e.g., different types of vegetation and land cover, water features and parks) that cool or warm the area (Q14-15). Personal thresholds for thermal comfort – both indoors and outdoors (Q19-20) – were also measured in Fahrenheit or Celsius for the most recent summer. Lastly, with yes/no responses, residents were asked (Q22) what they did last summer to cool their homes (e.g., use of air conditioning, swamp cooler, fans, misters, or various shading mechanisms) as well as if they have recently made changes to their home (e.g., weather-stripping, insulation) that affect temperatures (Q24).
- **Water Resources and Flooding:** A series of six statements were designed to evaluate residents' personal and local experiences with stormwater drainage and flooding (Q38). With a five-point disagree/agree scale, these included "I have experienced damage to my house due to flooding" and "Some of my neighbors' properties flood during rainstorms." Residents were also asked where water goes during large rainstorms, with six yes/no options such as "It stays on my property" and "It flows into the street" (Q39). Lastly, we asked what mechanism (i.e., rain barrel, rain garden, gutters, altered slope), if any, residents use to capture or retain rainwater (Q40).

Residential Landscaping Decisions

Since residential land is the most dominant land use in cities such as Phoenix, many survey questions probed residents about their landscape preferences and practices including assorted yard features, management inputs, and changes made to their property. Many of these questions came from previous versions of PASS (see Larson et al. 2009; 2017) or a survey designed by Larson (see Larson et al. 2010).

- **Landscape Choices:** Since the first PASS, residents have reported their preferred landscape types for front (Q25) and backyards (Q28) using four standard categories: mostly or all grass (known as mesic), mostly or all gravel (xeric), a mix of both grass and gravel (oasis), or a patio or courtyard, and an “other” option (see Larson et al. 2009; 2017). A few additional options, including bare dirt, were added in 2011 and 2017. The respondents also reported which of these most resembles their current front- and backyard landscapes (Q26 and Q29). For the 2017 PASS, we also pulled questions from the Larson et al. (2010) survey to gauge the portion of front and backyards covered by grass (Q27 and Q30) using five categories (none, less than half, about half, more than half, all).
- **Yard Management:** Additional questions were drawn from Larson’s survey (Larson et al. 2010) to record the frequency at which residents irrigate their yards in winter and summer months (Q31-32), along with whether or not they use fertilizers or pesticides (Q34-36). A single question also asks who makes the majority of decisions concerning yard management, including the person themselves or landscaping services/companies, and Homeowner’s Associations (Q33). These questions were newly added to PASS in 2017.
- **Landscape Changes:** Several survey questions asked if people have made certain modifications to their landscapes, as described in the earlier sections on heat mitigation and adaptation, as well as stormwater management. Other items included were: the addition or removal of grass, trees, desert plants, and concrete (Q37). Many but not all these questions were asked in the 2011 survey.

Demographics and Other Constructs

- **Personal and Household Attributes:** The demographic questions were mostly drawn from previous versions of PASS, with many worded similar to questions in the U.S. census. Starting with Q50 at the end of the 2017 survey, these include: household income and size; sex, age, and education of the respondent; employment status; place of birth and ethnicity/race; the number of years lived at the current address and in the Valley; whether they rent or own; live in an area with a Homeowner’s Association; and whether they have a private pool or not, and pets (cats and dogs).
- **Value Orientations:** Survey questions since the 2006 PASS have measured environmental values and political orientations, specifically on a seven-point scale from “very liberal” to “very conservative” with a “moderate” option in the middle (Q67). For environmental values, Dunlap et al.’s (2000) New Ecological Paradigm scale, which includes fifteen dis/agree statements, was included verbatim in both 2011 and 2017 (Q49). As a set of basic beliefs, these statements reflect environmental orientations or what is otherwise known as “ecological worldviews” – with emphasis on biocentric versus anthropocentric values (Larson 2010). Both of these measures are intended largely as basic explanatory or control variables in analyses of the factors affecting risk perception, environmental attitudes, and household decisions.
- **Social Capital:** Social capital is another commonly used social science construct that can serve as an explanatory variable for much of the data collected in PASS. Following Larsen et al. (2004), two questions gauge social capital, which can be defined as the strength of a social network based on principles such as trust, reciprocity, and norms. The four dis/agree statements included the following: “I can trust my neighbors,” and “I live in a close-knit neighborhood” (Q12). A second question (Q13) asks how often residents visit with their neighbors using a five-point scale ranging from “never” to “daily or almost daily.”

OVERVIEW OF STUDY NEIGHBORHOODS

Parcel Characteristics

The 2017 PASS neighborhoods were distributed spatially across the central (core) parts of the city, suburban areas, and along the urban fringe. Parcel characteristics were obtained from the 2017 tax assessor dataset. Built on average from 1953 to 2007, the age of the neighborhoods ranges from 10 to 64 years. The average parcel size is 12,779 square feet, with a range from 2,104 to 27,544. The average home value is \$359,336 with a low of \$69,000 and a high of \$876,000.

Yards in the Phoenix area commonly fall into three categories, as described here and shown below: **xeric** (a yard with crushed stone and native desert plants and trees), **oasis** (a yard with some grass and some crushed stone with plants, shrubs and trees), and **mesic** (a yard with grass, some shrubs and leafy trees). The study neighborhoods encompass these varied landscape designs.

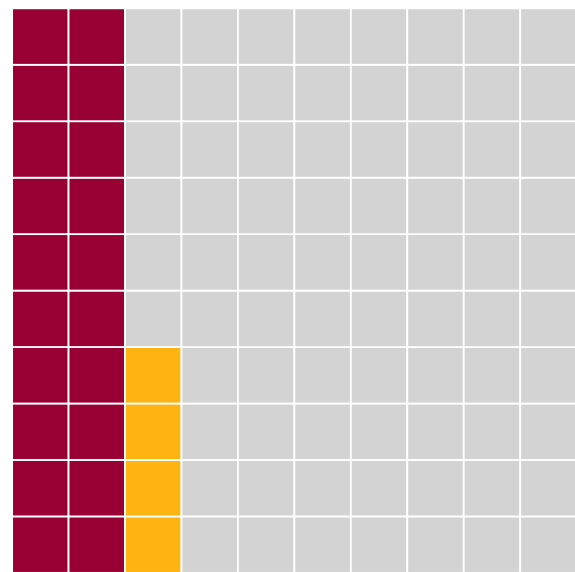
Typical (Average) Parcel Attributes

Age: 14 years (2002) **Parcel Size:** 12,779 sq. ft.
Value: \$359,336 **Pools:** 32% of parcels



A typical newer home in Phoenix-area suburbs: built in 1995, xeric landscaping, a clay tile roof, and stucco walls.

Parcel Composition (mean sq.ft. = 12,779)



1 square == 1% of total parcel

■ House (2,469 sq.ft.) ■ Patio (413 sq.ft.) ■ Yard (9,897 sq.ft.)

The average parcel composition of the 12 PASS neighborhoods surveyed in 2017.



Xeric



Oasis



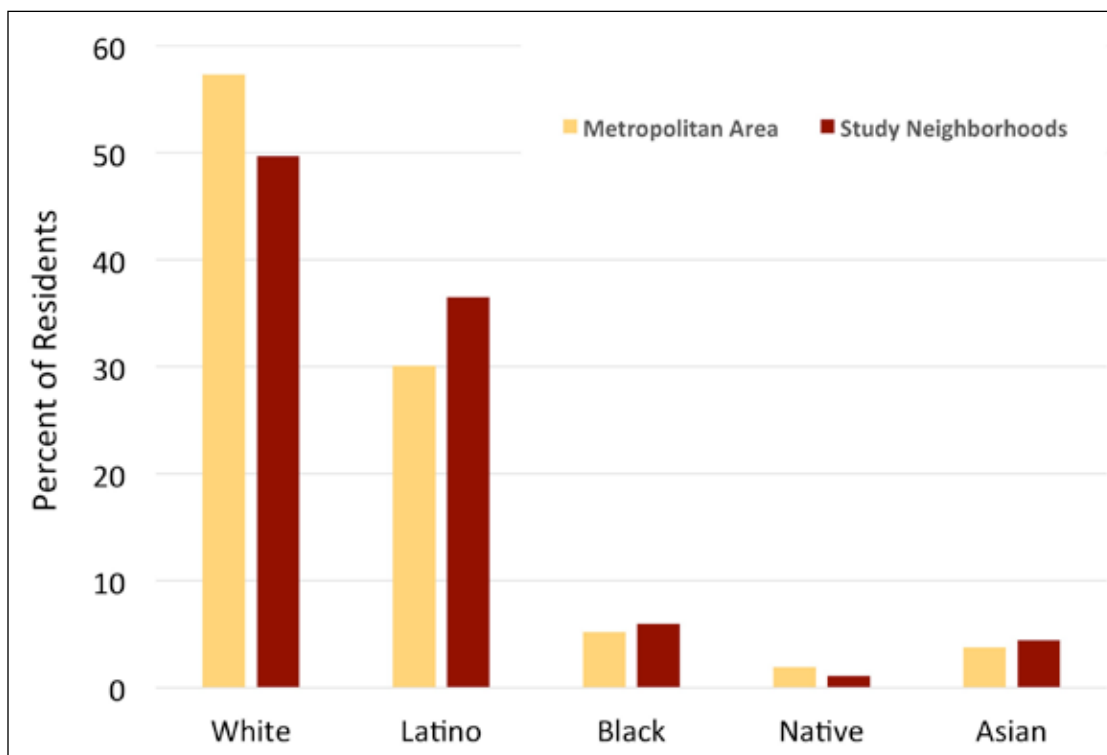
Mesic

Neighborhood Demographics

Demographic data for the PASS neighborhoods were collected from census block group data for 2015. Although the PASS neighborhoods vary demographically, they differ somewhat from the neighborhoods across the broader region. Relative to the greater Phoenix area (Maricopa County), the residents of the PASS study neighborhoods have a higher socioeconomic status in terms of both income and education. The households in the PASS neighborhoods are also slightly larger than those across the region, which reflects an over-sampling of areas with children and families and an under-sampling of areas with elderly populations. The ethnic and racial composition of the neighborhoods is comparable to that of the region. However, the study areas over-represent the Latino/Mexican community and under-represent white residents.

Demographics for Twelve Study Neighborhoods and the Phoenix Metropolitan Region

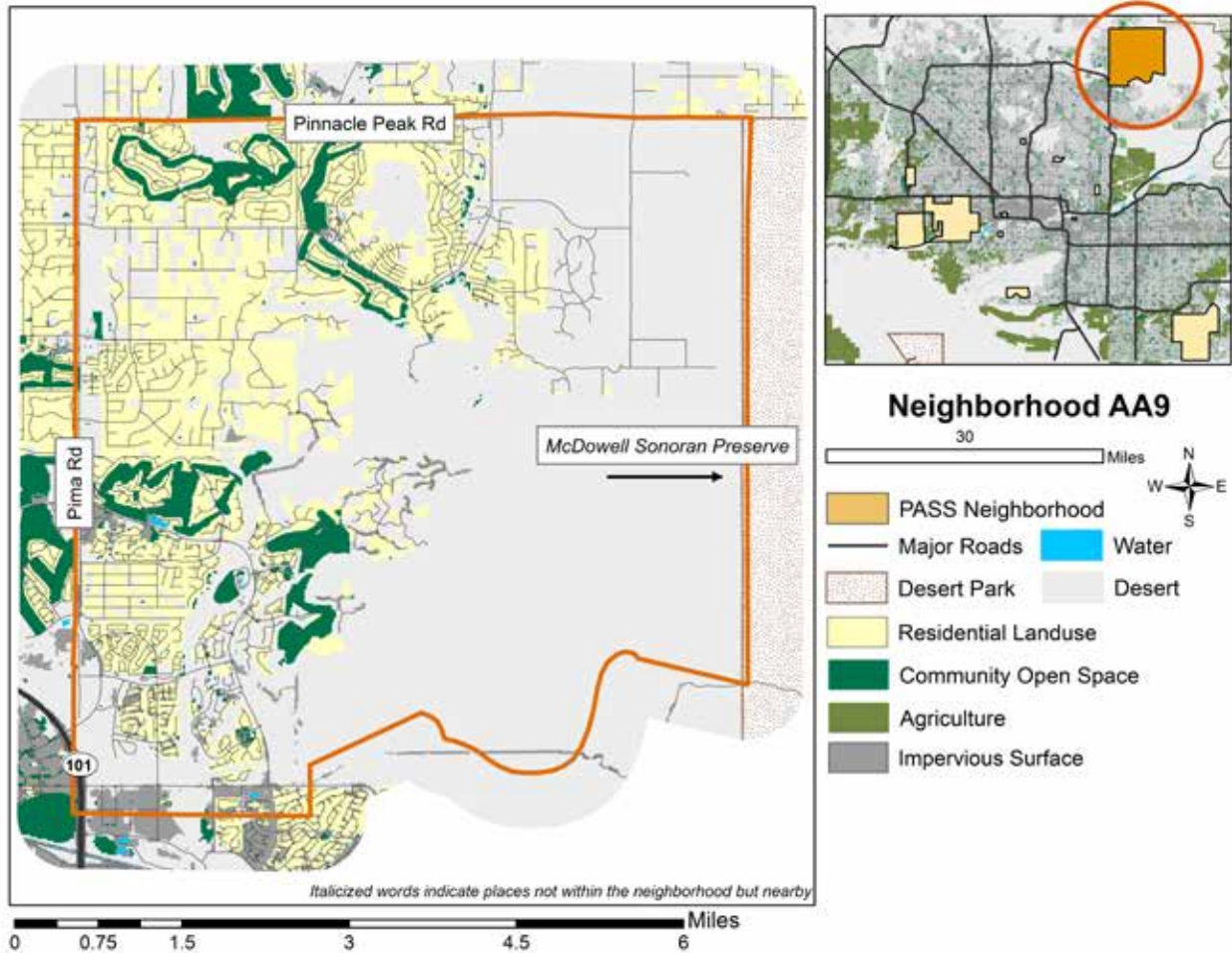
Demographic Variable	Metropolitan Area	Study Neighborhoods
Per Capita Income (Median)	\$28,769	\$37,955
Household Income (Median)	\$60,774	\$87,135
Owner-Occupied Homes	60.5%	70.3%
Bachelor's Degree	19.5%	22.6%
Graduate Degree	11.0%	13.9%
Household Size	2.8	3.3
Median Age	38.7	35.6
Population Under 18 (%)	25.3%	32.6%
Population Over 65 (%)	13.4%	8.5%
Male Population (%)	49.4%	49.0%



NEIGHBORHOOD PROFILES

NEIGHBORHOOD AA9 (SCOTTSDALE, AZ)

High-Income Fringe with a Desert Preserve and Significant Open Space



Highlights

1. Largest homes and yards of study neighborhoods; also, most expensive homes
2. Oldest median age of residents (54 years)
3. Mostly white (86%); Mexican/Latino (6%), Asian (5%), and black (1%)
4. Close access to desert park and prevalence of desert-specialist bird species

Description

Located at the northeastern fringe of the Phoenix metropolitan area, this neighborhood (AA9) borders the McDowell Sonoran Preserve and has a high percentage of open space (desert). Homes in this area are relatively new (the average year of housing development is 2000) and large, with private pools in about two-thirds (63%) of residents' yards. The landscaping in the neighborhood is mostly xeric, and this neighborhood also has a high prevalence of native bird species. The residents of the area exhibit relatively high socioeconomic status; the median household income is \$148,445, and 63% of the population has a bachelor's degree or higher level of education (28% have post-baccalaureate degrees). The majority of the individuals that live in the neighborhood are white (86%). With an average household size of 2.43, residents tend to be older individuals (around 25% are >65 years) with fewer young children compared to the other PASS neighborhoods.

Home and Parcel Information (from Tax Assessor data, 2017)

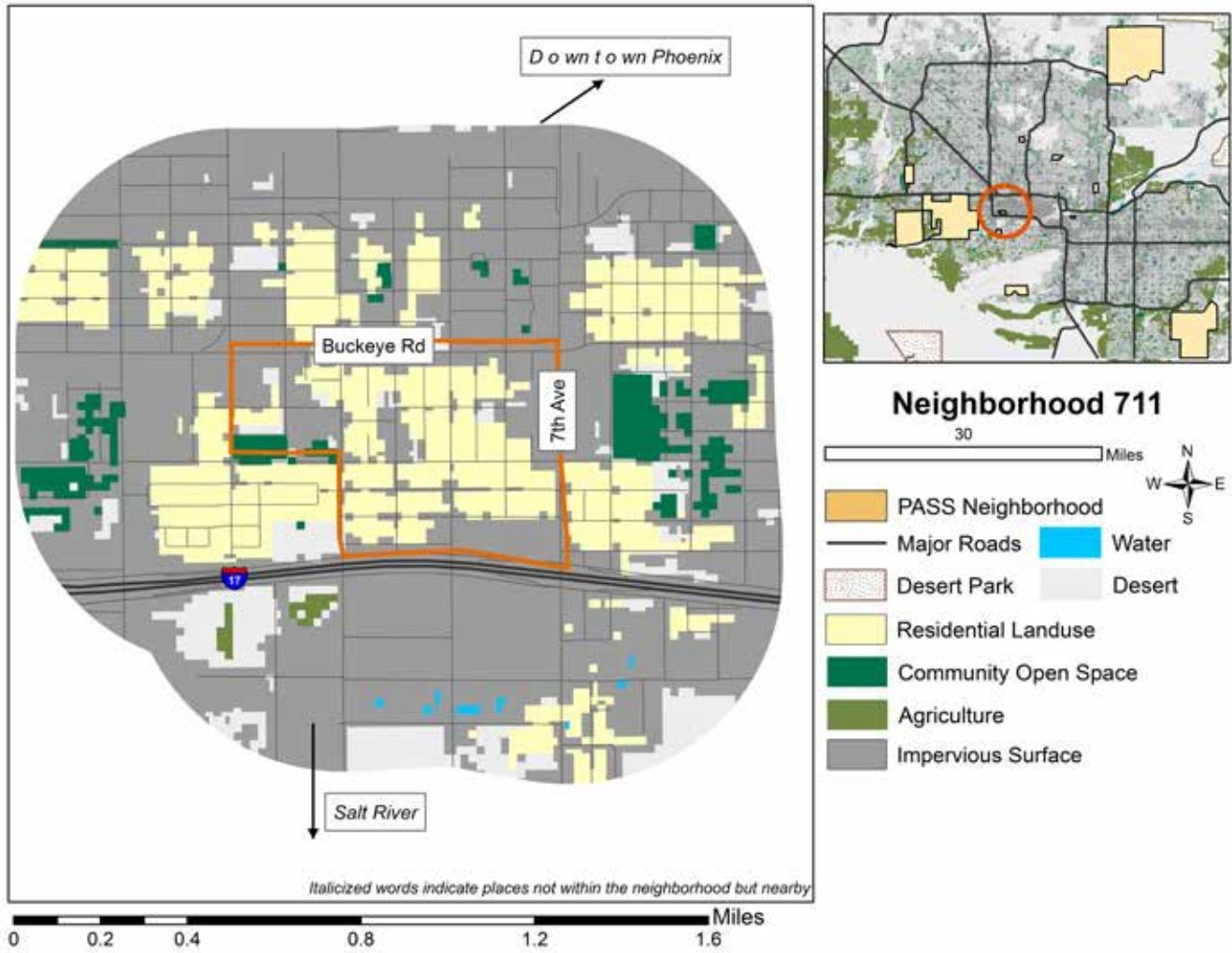
Variable	Study Area AA9	All Neighborhoods
Parcel Area (sq. ft.)	27,544 ± 547	12,779 ± 119
House Size (sq. ft.)	3,497 ± 18.6	2,469 ± 5.42
House Age (years)	16.74 ± 0.08	14.73 ± 0.05
Price (\$)	\$876,769 ± 8,614	\$359,336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area AA9	All Neighborhoods
Household Income (median)	\$148,445	\$87,135
White (%), Mexican/Latino (%)	85.65, 6.37	48.69, 36.51
Median Age (years)	54.29	35.61
Bachelor's Degree or Above (%)	63.45	36.56
Owner Occupied (%)	86.34	70.3
Household Size	2.43	3.31

NEIGHBORHOOD 711 (PHOENIX, AZ)

Low-Income Urban Core (Downtown Phoenix)



Highlights

1. Older urban neighborhood (built in the 1970s) with low per-capita income
2. Largely Mexican/Latino (77%); white (15%), black (9%), & Native (2%)
3. Little vegetation in neighborhood with high levels of concrete and pavement
4. Lowest bird richness and diversity of neighborhoods

Description

Located in downtown Phoenix, this neighborhood (711) is surrounded by a high percentage of impervious surface (concrete, pavement, etc.). A railroad track also cuts through the neighborhood. The area is relatively old and has smaller homes and parcel sizes. The landscaping in private yards is predominately xeric or packed dirt, with large amounts of crushed gravel and very little vegetation. The residents of the neighborhood exhibit relatively low socioeconomic status; the median household income is \$37,109, and only 4% of the population has a bachelor's degree or higher level of education. The majority of the individuals that live in the neighborhood are Mexican or Latino, with the highest population of non-English speaking residents. The average household size is relatively large at 4.53 people. Residents tend to be younger, including a large percentage of children (36% of the population is aged 0-18) and a relatively low portion (6%) of residents who are 65 or older.

Home and Parcel Information (from Tax Assessor data, 2017)

Variable	Study Area 711	All Neighborhoods
Parcel Area (sq. ft.)	6,177 ± 61	12,779 ± 119
House Size (sq. ft.)	1,119 ± 17.5	2,469 ± 5.42
House Age (years)	46.35 ± 1.49	14.73 ± 0.05
Price (\$)	\$80,132 ± 6, 897	\$359,336 ± 3,159

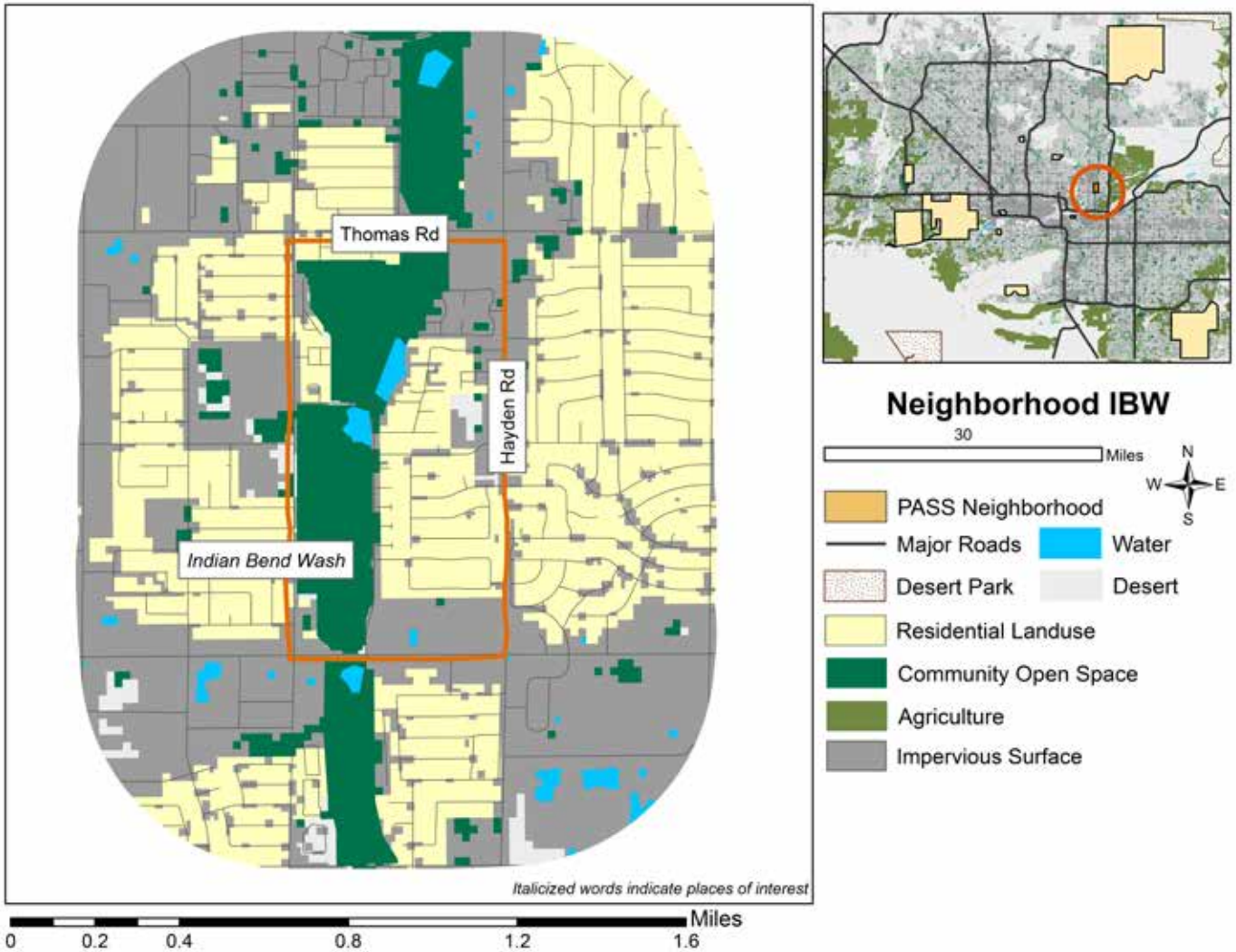
Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area 711	All Neighborhoods
Household Income (median)	\$37,109	\$87,135
White (%), Mexican/Latino (%)	14.55, 77.11	48.69, 36.51
Median Age (years)	25.3	35.61
Bachelor's Degree or Above (%)	3.46	36.56
Owner Occupied (%)	37.7	70.3
Household Size	4.53	3.31

Neighborhood IBW (Scottsdale, AZ)

NEIGHBORHOOD IBW (SCOTTSDALE, AZ)

Flood Retention Greenway in an Inner Suburban Context



Highlights

1. Neighborhood encompasses a flood retention project that also serves as a park
2. Middle-income and above-average education residents; many town/patio homes
3. Mostly white (82%); Mexican/Latino (11%), Asian (5%), & black (1%)
4. Landscaping is mixed with grassy (mesic) and desert (xeric) yards

Description

Located in south Scottsdale and in close proximity to Arizona State University, this neighborhood (IBW) encompasses a flood retention zone – known as Indian Bend Wash – that also functions as a neighborhood park and greenway. Homes in the area are relatively old and have the smallest square footage among study neighborhoods, with a large percentage of townhouses and patio homes. Residential landscaping is predominately oasis, with a high prevalence of grassy lawns but a mix of xeric, desert-like yards as well. The demographics resemble a middle-class neighborhood; the median household income is \$59,643, and 54% of the population has a bachelor's degree or higher level of education (19% have post-baccalaureate degrees). The majority of the individuals that live in the neighborhood are white. With an average household size of 1.9 and a relatively low portion of children (3%) living in the area, residents tend to be relatively young adults (nearly half are aged 18-34).

Home and Parcel Information (from Tax Assessor data, 2017)

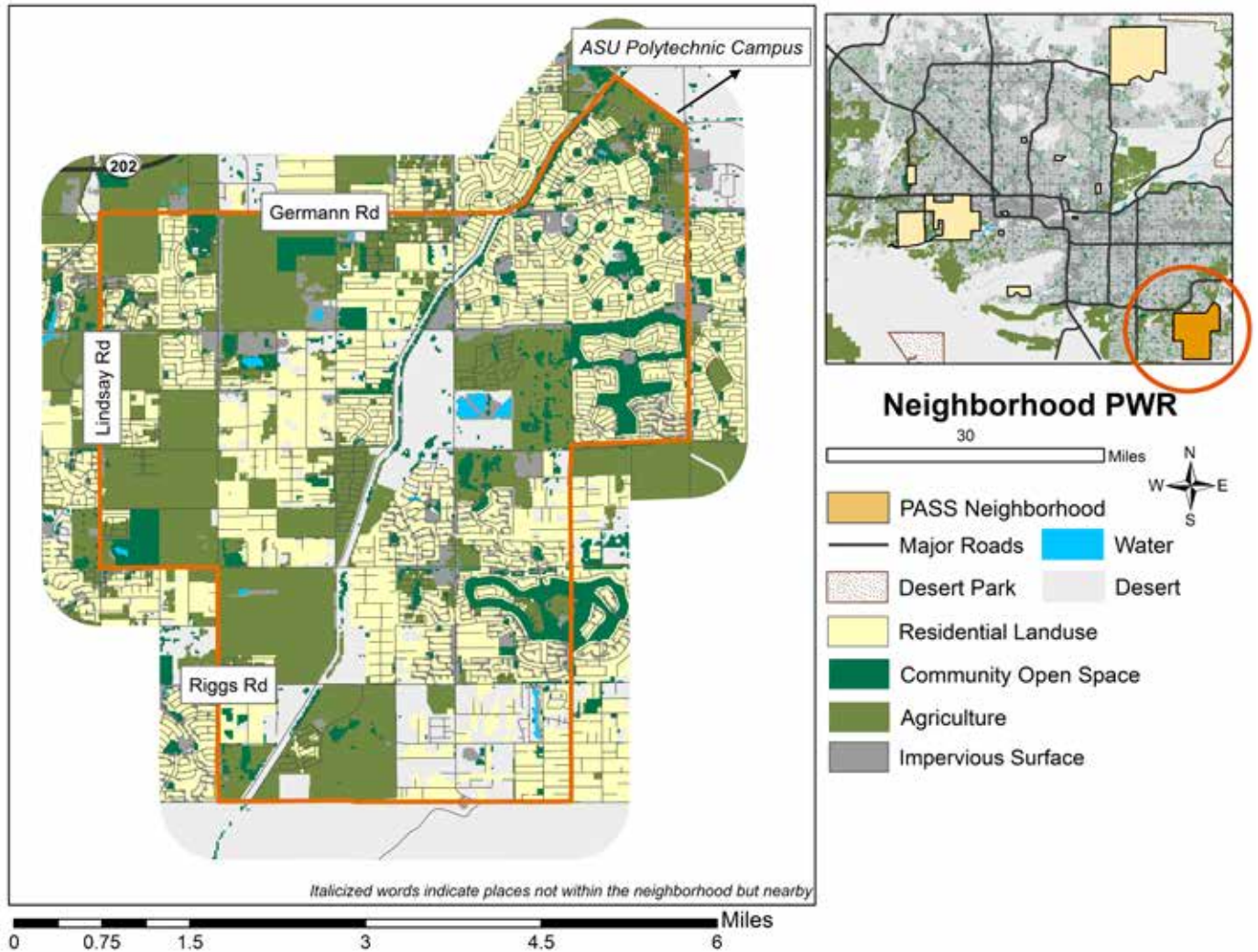
Variable	Study Area IBW	All Neighborhoods
Parcel Area (sq. ft.)	4,687 ± 94.3	12,779 ± 119
House Size (sq. ft.)	1,641 ± 14.4	2,469 ± 5.42
House Age (years)	43.49 ± 0.38	14.73 ± 0.05
Price (\$)	\$197,028 ± 2, 817	\$359,336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area IBW	All Neighborhoods
Household Income (median)	\$59,643	\$87,135
White (%), Mexican/Latino (%)	81.94, 10.56	48.69, 36.51
Median Age (years)	33.50	35.61
Bachelor's Degree or Above (%)	54.23	36.56
Owner Occupied (%)	51.62	70.3
Household Size	1.9	3.31

NEIGHBORHOOD PWR (GILBERT, AZ)

Urban–Agricultural Fringe near ASU's East (Polytechnic) Campus



Highlights

1. Newest neighborhood in terms of average home age (on average, 10 years)
2. Homes are a mix of suburban developments and large agricultural properties
3. Mostly white (74%); Mexican/Latino (13%), Asian (7%), black (3%), Native (1%)
4. Mixed land uses: residential and agricultural, with open spaces throughout

Description

Located in southeast Gilbert and near Arizona State University's Polytechnic (East Valley) campus, this neighborhood (PWR) is primarily residential and agricultural (cultivated crops and vegetation) with several urban parks (some serve as flood retention areas) and golf courses as open spaces. With relatively recent urban (residential) development, neighborhood homes are new and most resemble suburban cul-de-sacs with stucco walls and clay tile roofs. Residential landscaping is well mixed with mesic, oasis, and xeric yards. Interestingly, the neighborhood has the highest bird richness among the study neighborhoods. The demographics resemble a middle-class neighborhood; the median household income is \$87,716, and 44% of the population has a bachelor's degree or higher level of education. The majority of the individuals that live in the neighborhood are white. The average household size of 3.3 residents indicates households with young children (36% aged 0-18) and their parents (30% of the population is aged 25-44).

Home and Parcel Information (from Tax Assessor data, 2017)

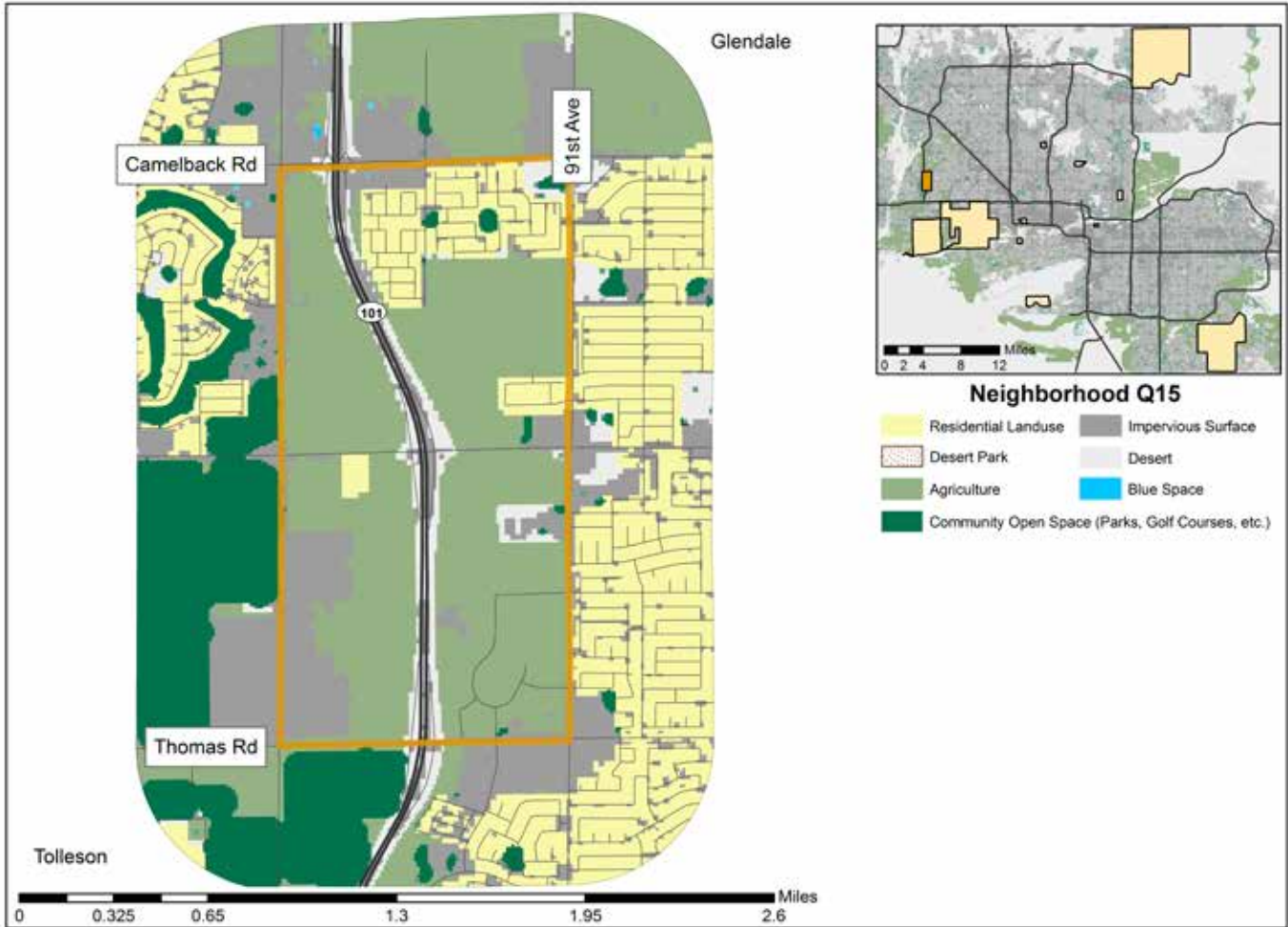
Variable	Study Area PWR	All Neighborhoods
Parcel Area (sq. ft.)	11, 560 ± 118	12, 779 ± 119
House Size (sq. ft.)	2, 537 ± 6.6	2, 469 ± 5.42
House Age (years)	9.89 ± 0.04	14.73 ± 0.05
Price (\$)	\$311, 374 ± 1, 509	\$359, 336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area PWR	All Neighborhoods
Household Income (median)	\$87, 716	\$87, 135
White (%), Mexican/Latino (%)	73.57, 13.91	48.69, 36.51
Median Age (years)	35.02	35.61
Bachelor's Degree or Above (%)	44.33	36.56
Owner Occupied (%)	80.68	70.3
Household Size	3.3	3.31

NEIGHBORHOOD Q15 (PHOENIX, AZ)

Urban-Agricultural Neighborhood in the West Valley



Highlights

1. Newer homes (built, on average, in 2001) with mixed landscaping
2. Land use has recently shifted from agricultural to residential developments
3. Mostly Mexican/Latino (66%); white (24%), Asian (5%), black (4%), Native (1%)
4. Close proximity to two major sports arenas (football and hockey)

Description

Located at the western edge of Phoenix, this neighborhood (Q15) shares many land use and home traits with the PWR neighborhood in the East Valley. Historically agricultural land, residential development has occurred in recent years. Thus, homes in the area are relatively new, built around the turn of the century. The landscaping in residential neighborhoods is mixed, with the majority of homes having xeric or oasis yards. The neighborhood has two urban parks within its boundaries. The demographics resemble a middle-class population; the median household income is \$69,082, but only 17% of residents have a bachelor's degree or higher level of education. The majority of the individuals that live in the neighborhood are Mexican or Latino, but the racial composition is relatively mixed. With an average size of 3.68 people, households tend to be families with young children (26% of the population is aged 0-18); relatively few people (2%) are 65 years or older.

Home and Parcel Information (from Tax Assessor data, 2017)

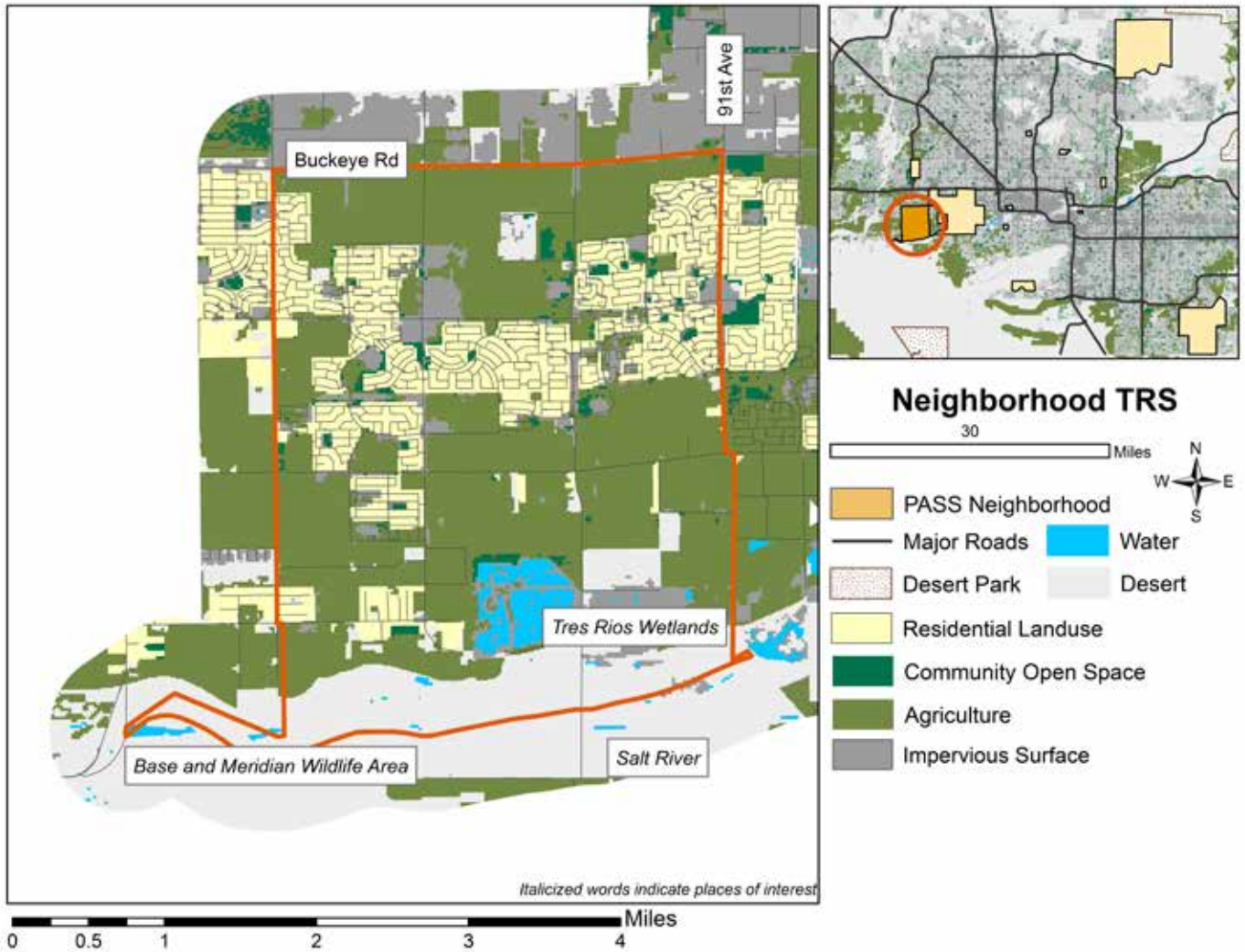
Variable	Study Area Q15	All Neighborhoods
Parcel Area (sq. ft.)	7, 438 ± 420	12, 779 ± 119
House Size (sq. ft.)	2, 163 ± 4.7	2, 469 ± 5.42
House Age (years)	15.99 ± 0.06	14.73 ± 0.05
Price (\$)	\$175, 014 ± 13, 887	\$359, 336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area Q15	All Neighborhoods
Household Income (median)	\$69, 082	\$87, 135
White (%), Mexican/Latino (%)	24.24, 65.62	48.69, 36.51
Median Age (years)	27.5	35.61
Bachelor's Degree or Above (%)	16.94	36.56
Owner Occupied (%)	65.58	70.3
Household Size	3.68	3.31

NEIGHBORHOOD TRS (PHOENIX, AZ)

West Agricultural Fringe near the Tres Rios Wetlands and a Wildlife Area



Highlights

1. Newer homes (built, on average, in 2006) surrounded by agricultural lands
2. Highest percent of children among study neighborhoods
3. Mostly Mexican/Latino (66%); white (17%), black (12%), Native & Asian (1% each)
4. The local blue-green infrastructure has been actively restored and managed

Description

Located at the southwest fringe of the metro area, this neighborhood (TRS) is a mix of residential and agricultural land. The homes are relatively new, established around 2006, but the neighborhood also has older agricultural properties with flood irrigation and large lots. The residential landscaping is mixed, with the majority of homes having xeric or oasis yards. The neighborhood borders the Salt River and includes the Tres Rios Wetlands, which the City of Phoenix developed for wastewater treatment and to restore native riparian vegetation and wildlife habitat. The local water infrastructure, along with a nearby wildlife area, have been actively restored and offer outdoor amenities. The median household income is \$58,963, but only 15% of the population has a bachelor's degree or higher level of education. Though the majority of residents are Mexican or Latino, the area is fairly diverse. With an average size of 3.93 people, households tend to be families with young children (33% of the population is aged 0-18).

Home and Parcel Information (from Tax Assessor data, 2017)

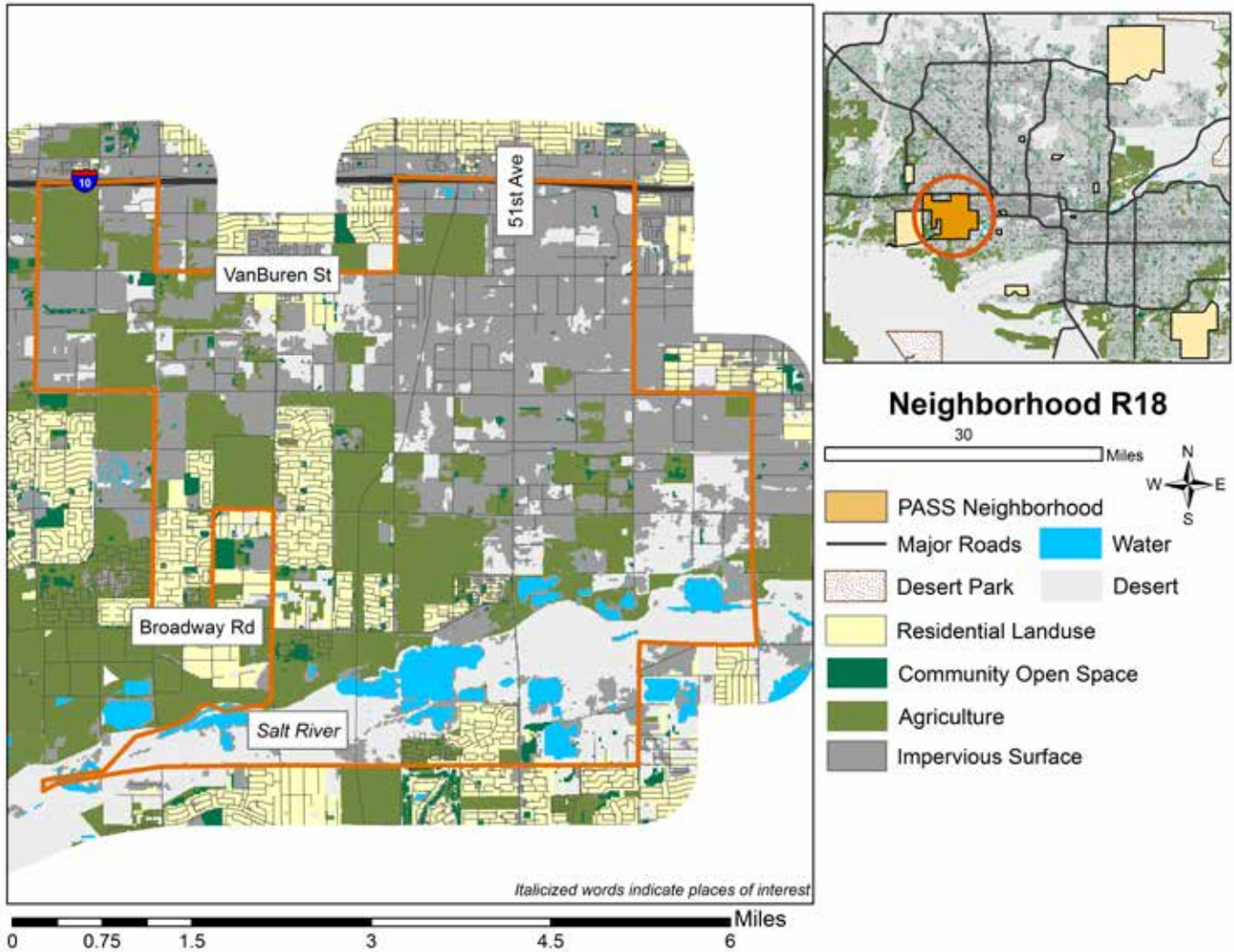
Variable	Study Area TRS	All Neighborhoods
Parcel Area (sq. ft.)	6,800 ± 129	12,779 ± 119
House Size (sq. ft.)	1,999 ± 5.6	2,469 ± 5.42
House Age (years)	11.27 ± 0.05	14.73 ± 0.05
Price (\$)	\$171,486 ± 2, 925	\$359,336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area TRS	All Neighborhoods
Household Income (median)	\$58, 963	\$87, 135
White (%), Mexican/Latino (%)	17.36, 66.32	48.69, 36.51
Median Age (years)	25.93	35.61
Bachelor's Degree or Above (%)	15.58	36.56
Owner Occupied (%)	64.52	70.3
Household Size	3.93	3.31

NEIGHBORHOOD R18 (PHOENIX, AZ)

Mixed-Development Area near the Salt River Channel in West Phoenix



Highlights

1. Newer homes (on average, built around 2003); relatively middle-income residents
2. Homes are a mix of suburban construction and large agricultural properties
3. Mostly Mexican/Latino (69%); black (12%), white (12%), Native (4%) & Asian (2%)
4. Area borders unmanaged section of the Salt River Channel

Description

Located in southwest Phoenix, this neighborhood (R18) shares many demographic and land use traits with the TRS neighborhood. The biggest difference is that the nearby Salt River Channel is a dry, unmanaged reach of the stream. Land use is heterogeneous with a mixture of residential and agricultural properties. Land cover is a mix of agricultural crops but there is also a high percentage of impervious surface in the area. The average home age is relatively new (built around 2003), but the neighborhood also has older agricultural properties with flood irrigation and large lots. The median household income is \$47,871, and only 12% of the population has a bachelor's degree or higher education. The majority of the individuals that live in the neighborhood are Mexican or Latino, the area is quite diverse and is home to the largest portion of black residents among our study areas. With an average size of 4.0 people, households tend to be families with young children (33% of the population is aged 0-18).

Home and Parcel Information (from Tax Assessor data, 2017)

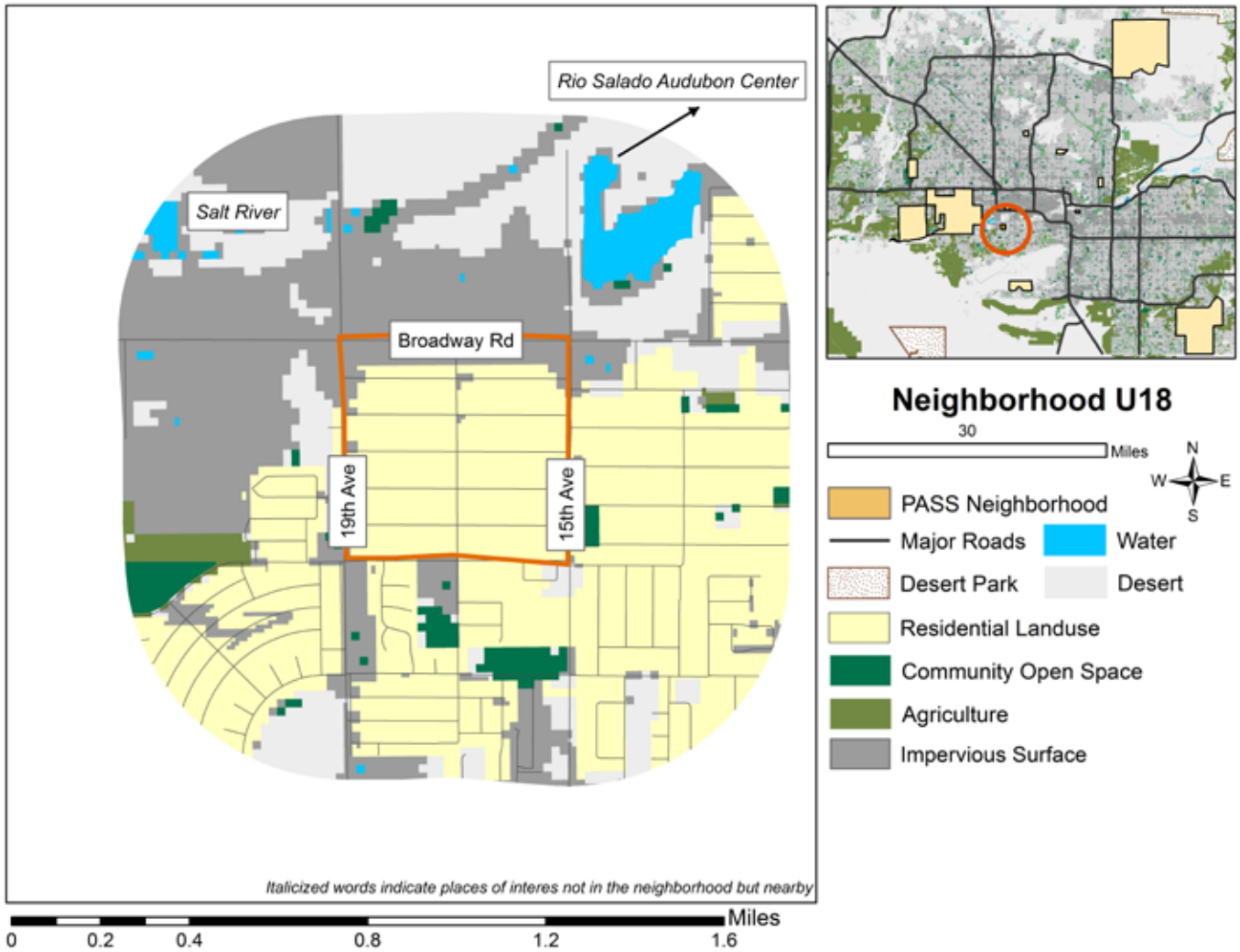
Variable	Study Area R18	All Neighborhoods
Parcel Area (sq. ft.)	7,122 ± 160	12,779 ± 119
House Size (sq. ft.)	1,760 ± 6.7	2,469 ± 5.42
House Age (years)	14.40 ± 0.11	14.73 ± 0.05
Price (\$)	\$178,717 ± 20, 528	\$359,336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area R18	All Neighborhoods
Household Income (median)	\$47,871	\$87,135
White (%), Mexican/Latino (%)	12.05, 68.79	48.69, 36.51
Median Age (years)	25.7	35.61
Bachelor's Degree or Above (%)	12.50	36.56
Owner Occupied (%)	53.41	70.3
Household Size	3.93	3.31

NEIGHBORHOOD U18 (PHOENIX, AZ)

Low-Income, Urban Core near a Restored Section of the Salt River Channel



Highlights

1. Oldest homes (built in 1950s) & lowest priced homes among study neighborhoods
2. Relatively low socioeconomic status in terms of income and education
3. Mostly Mexican/Latino (93%); white (5%) and black (1%)
4. Largest average household size with lots of children

Description

Located in the southern portion of central Phoenix, this neighborhood (U18) has a significant amount of impervious surface nearby. It is located south of a restored reach (the Rio Salado habitat restoration area) of the Salt River. The neighborhood is the oldest among the study neighborhoods, with average age of development being 1953. The local landscaping is predominately oasis or xeric, with large amounts of grass in front yards – perhaps due to its historic access to flood irrigation. The homes and yards in this area are well-maintained. The residents, on average, have the lowest socioeconomic status amongst the study neighborhoods. For example, the median household income is \$36,667, and only 3% of the population has a bachelor's degree or higher level of education. This neighborhood also has the highest percentage of Mexican or Latino residents. The average household size is also the largest among the study neighborhood; at 4.55 people per household, the residents include a large percentage of children (35% of the population is aged 0-18).

Home and Parcel Information (from Tax Assessor data, 2017)

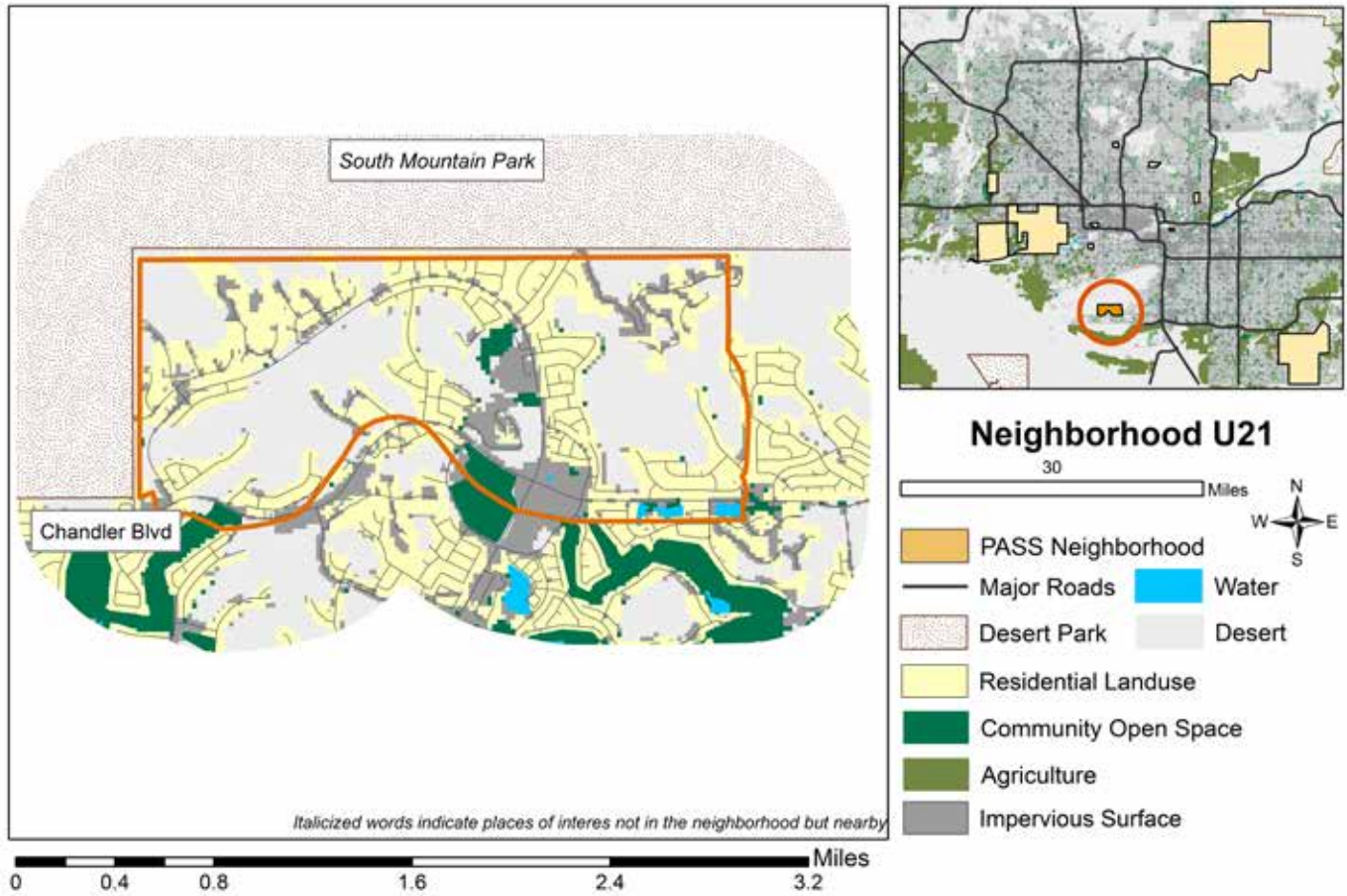
Variable	Study Area U18	All Neighborhoods
Parcel Area (sq. ft.)	11,058 ± 18.8	12,779 ± 119
House Size (sq. ft.)	1,080 ± 16.6	2,469 ± 5.42
House Age (years)	64.14 ± 0.31	14.73 ± 0.05
Price (\$)	\$68,960 ± 1, 956	\$359,336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area U18	All Neighborhoods
Household Income (median)	\$36,667	\$87,135
White (%), Mexican/Latino (%)	5.39, 93.32	48.69, 36.51
Median Age (years)	25.20	35.61
Bachelor's Degree or Above (%)	3.26	36.56
Owner Occupied (%)	42.81	70.3
Household Size	4.55	3.31

NEIGHBORHOOD U21 (PHOENIX, AZ)

High Income Cul-de-sac near South Mountain Preserve & Other Open Space



Highlights

1. Large homes on relatively small parcels with pools
2. Highest percent of family households among study neighborhoods
3. Mostly white (76%); Mexican/Latino (8%), Asian (8%), & black (4%)
4. Close access to desert park and highest bird diversity values

Description

Nestled at the base of the South Mountain Preserve, in the southern most point in the City of Phoenix, this mostly residential area (U21) is surrounded by a large amount of open (desert) space. South Mountain offers over 16,000 acres and 51 miles of park space. The homes in the area are large and relatively new (average year build is 1995), with the highest percent of ownership. The landscaping is predominately xeric, and the neighborhood has the highest levels of bird diversity among the study neighborhoods. Over three-fourths (76%) of homes have a pool in their private yards, and the area has a relatively high socioeconomic status. The median household income is \$139,055, and 65% of the population has a bachelor's degree or higher level of education (27% have post-baccalaureate degrees). The majority of the individuals that live in the neighborhood are white. With an average size of 3 residents, households tend to be families with young children (27% of the population is aged 0-18) and their parents.

Home and Parcel Information (from Tax Assessor data, 2017)

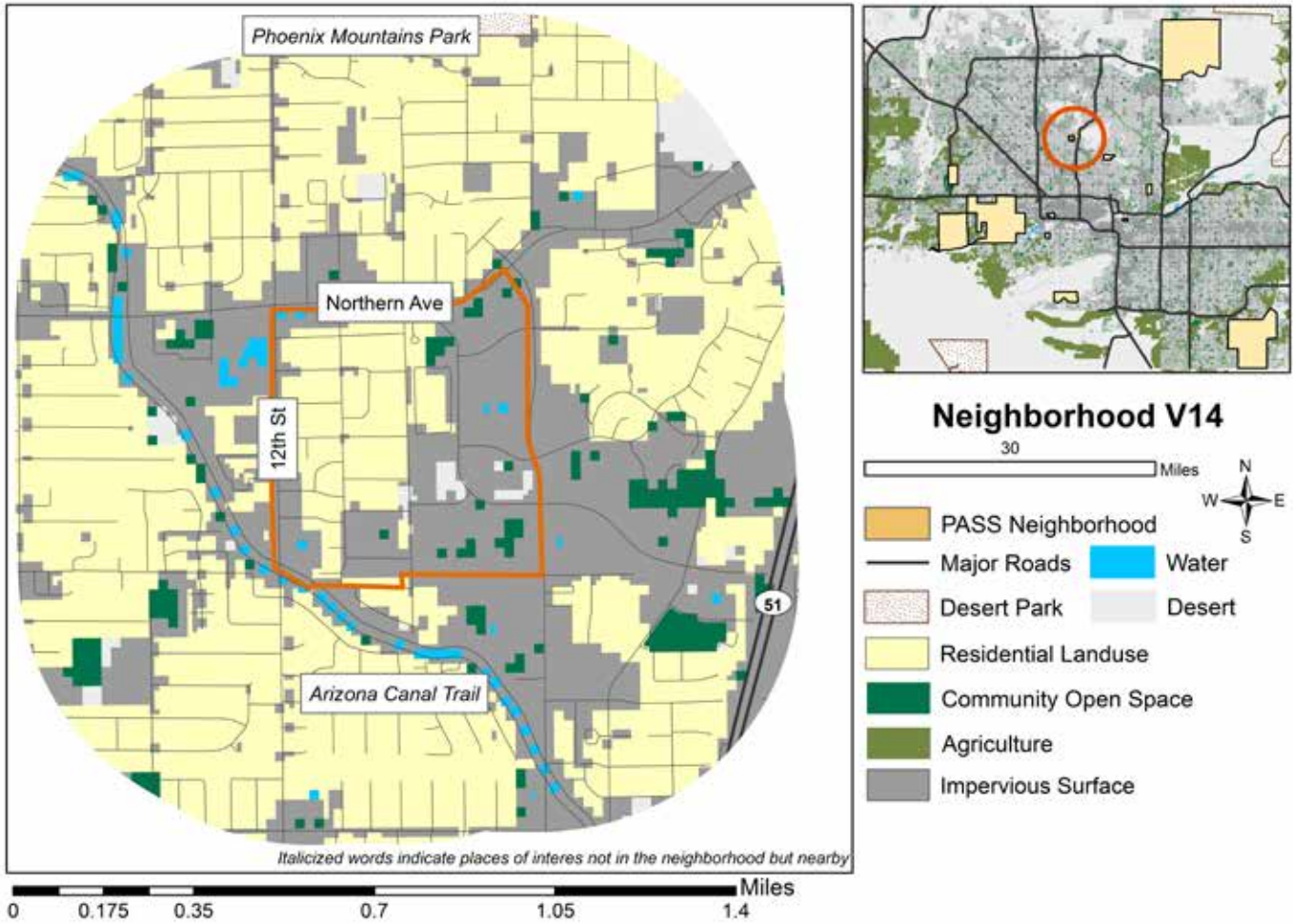
Variable	Study Area U21	All Neighborhoods
Parcel Area (sq. ft.)	11,619 ± 392	12,779 ± 119
House Size (sq. ft.)	2,837 ± 21.5	2,469 ± 5.42
House Age (years)	21.58 ± 0.10	14.73 ± 0.05
Price (\$)	\$418,734 ± 5, 683	\$359, 336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area U21	All Neighborhoods
Household Income (median)	\$139,055	\$87,135
White (%), Mexican/Latino (%)	76.17, 8.62	48.69, 36.51
Median Age (years)	43.20	35.61
Bachelor's Degree or Above (%)	65.31	36.56
Owner Occupied (%)	95.71	70.3
Household Size	3.03	3.31

NEIGHBORHOOD V14 (PHOENIX, AZ)

North-Central Corridor near the Arizona Canal Trail and Phoenix Mountains



Highlights

1. Older homes have mesic landscaping and newer ones have xeric landscaping
2. Mostly white (71%) & Mexican/Latino (19%); Asian (9%) and black (1%)
3. Borders the 69-mile Arizona Canal Trail with the Phoenix Mountains nearby
4. Lowest bird abundance among study neighborhoods

Description

Located in the North-Central Corridor of Phoenix, this neighborhood (V14) is primarily residential with high levels of impervious surface nearby. The Arizona Canal and the associated multi-use trail border the neighborhood. Homes are fairly old (on average, built in 1981), but the neighborhood is in transition as newer development has occurred in recent years. The area encompasses older mesic parcels neighboring remodeled homes with xeric landscaping. Though the area has large, mature shade trees, bird abundance is low. The population is middle class; the median household income is \$47,217, and 22% of the population has a bachelor's degree or higher level of education. The residents are mostly white but somewhat diverse, especially with a significant Mexican/Latino population and the largest amount of Asian residents among the neighborhoods surveyed. Household size is relatively small, with 2 residents per household at the average age of 46 years and about 30% between the ages of 45 and 64.

Home and Parcel Information (from Tax Assessor data, 2017)

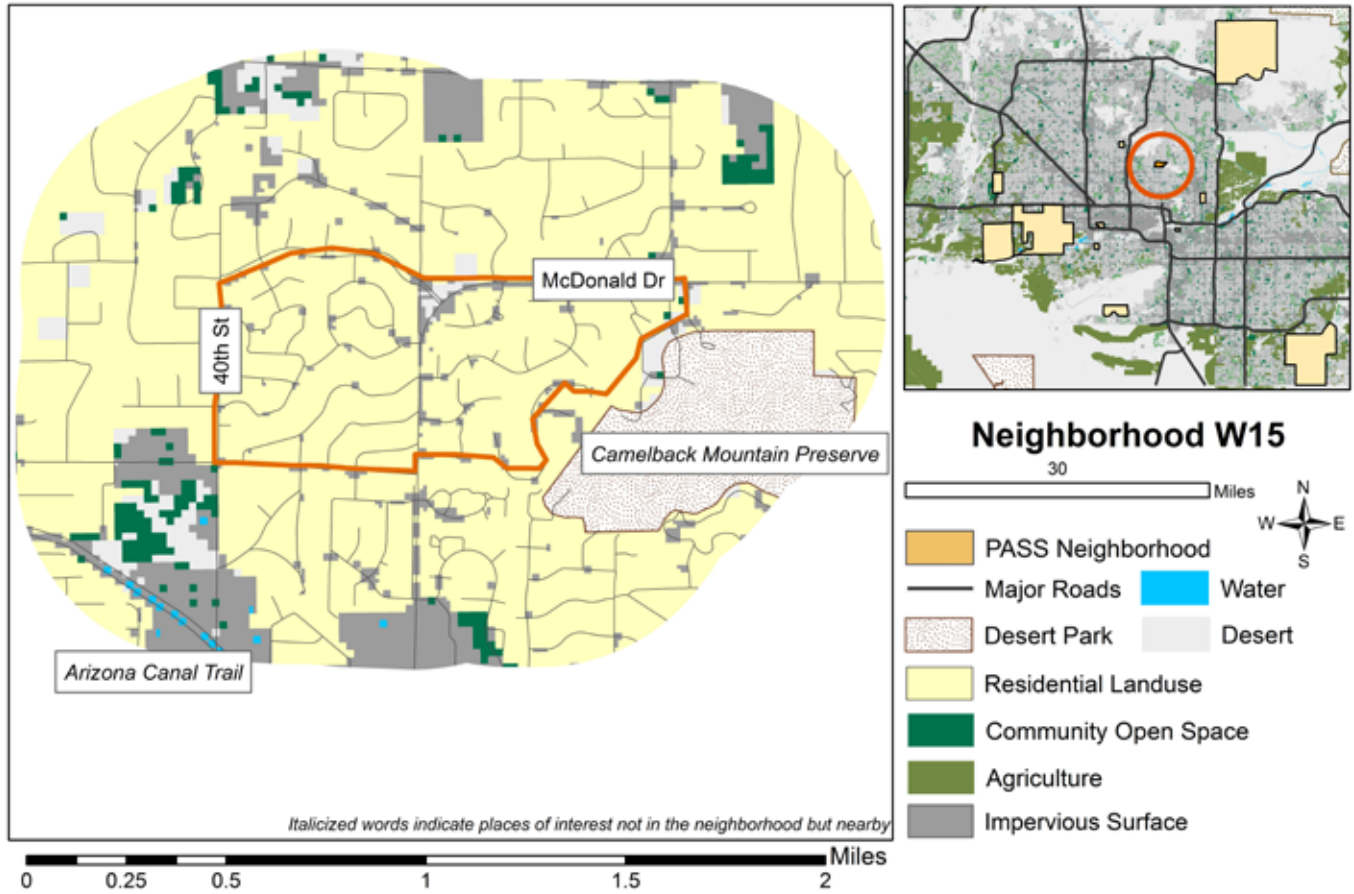
Variable	Study Area V14	All Neighborhoods
Parcel Area (sq. ft.)	3,943 ± 195	12,779 ± 119
House Size (sq. ft.)	1,168 ± 17.9	2,469 ± 5.42
House Age (years)	35.86 ± 0.75	14.73 ± 0.05
Price (\$)	\$165,056 ± 6, 435	\$359,336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area V14	All Neighborhoods
Household Income (median)	\$47,217	\$87,135
White (%), Mexican/Latino (%)	70.87, 18.79	48.69, 36.51
Median Age (years)	46.2	35.61
Bachelor's Degree or Above (%)	22.47	36.56
Owner Occupied (%)	17.55	70.3
Household Size	2.02	3.31

NEIGHBORHOOD W15 (PHOENIX, AZ)

High-Income, Central Mountain Residential Area



Highlights

1. Older neighborhood in the urban center of Metropolitan Phoenix
2. High home values, high income, and older residents
3. Mostly white (88%); Mexican/Latino (5%), Asian (4%), & black (1%)
4. Borders a small desert preserve with a multi-use urban trail system nearby

Description

Situated at the base of a small desert preserve known as Camelback Mountain in central Phoenix, this predominantly residential area (W15) borders the Arizona Canal and the associated 69-mile, multi-use trail. The area is relatively mature in terms of housing, with 1968 as the average age of development. The yards predominately have mature xeric landscaping, and about two-thirds of homes have a pool in their private yards. The residents have a relatively high socioeconomic status; the median household income is \$152, 222, and 72% of the population has a bachelor's degree or higher level of education (41% have post-baccalaureate degrees). The majority of the individuals that live in the neighborhood are white (87%). With an average household size of 2.4 individuals, the residents are the oldest among the study neighborhoods (25% of the population is 65+ and 34% is 45-64).

Home and Parcel Information (from Tax Assessor data, 2017)

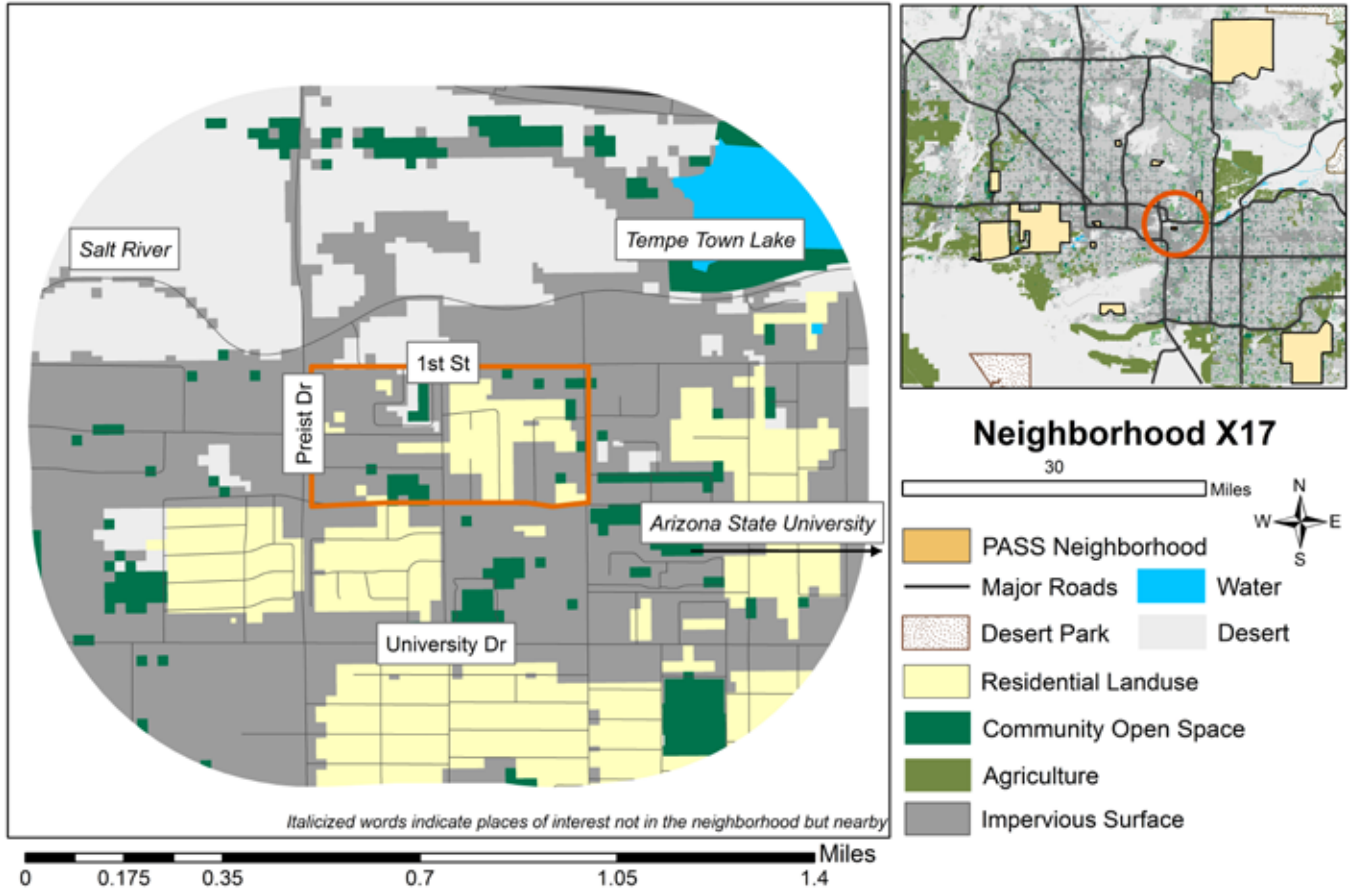
Variable	Study Area W15	All Neighborhoods
Parcel Area (sq. ft.)	19,232 ± 350	12,779 ± 119
House Size (sq. ft.)	2,912 ± 38.0	2,469 ± 5.42
House Age (years)	48.66 ± 0.6	14.73 ± 0.05
Price (\$)	\$672,758 ± 14, 990	\$359,336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area W15	All Neighborhoods
Household Income (median)	\$152,222	\$87,135
White (%), Mexican/Latino (%)	87.65, 5.22	48.69, 36.51
Median Age (years)	52.1	35.61
Bachelor's Degree or Above (%)	72.34	36.56
Owner Occupied (%)	88.40	70.3
Household Size	2.41	3.31

NEIGHBORHOOD X17 (PHOENIX, AZ)

Central University Neighborhood near Tempe Town Lake (Salt River Channel)



Highlights

1. Neighborhood borders an artificial lake developed in the Salt River channel
2. Above-average education levels with lower home values, racially diverse
3. White (50%), Mexican/Latino (29%), black (1%), Native (7%), and Asian (5%)
4. Landscaping is mixed, increased grass and vegetation

Description

Located in Tempe within walking distance of Arizona State University's central campus, this neighborhood (X17) borders the Salt River and associated accidental wetlands and is also adjacent to Tempe Town Lake – an artificial water body created in the otherwise dry Salt River channel. Neighborhood homes are relatively old (built, on average, around 1982) and have a small square footage, with a large percentage of townhomes and condos. The local landscaping is predominately mesic lawns or mixed oasis yards. The median household income is \$57,696, and 56% of the population has a bachelor's degree or higher level of education (12% have post-baccalaureate degrees). The racial and ethnic composition of the neighborhood is most diverse among the study areas; 50% of residents are white, 30% are Mexican or Latino, and 7% are Native. The average household size is 2.43, with residents tending to be families (21% of the population is under 18) or young adults (35% of individuals are 25-34).

Home and Parcel Information (from Tax Assessor data, 2017)

Variable	Study Area X17	All Neighborhoods
Parcel Area (sq. ft.)	2,105 ± 200	12,779 ± 119
House Size (sq. ft.)	1,065 ± 16.8	2,469 ± 5.42
House Age (years)	34.58 ± 0.88	14.73 ± 0.05
Price (\$)	\$138,172 ± 3, 921	\$359, 336 ± 3,159

Demographic and Economic Information (from U.S. Census Bureau, 2015)

Variable	Study Area X17	All Neighborhoods
Household Income (median)	\$57, 696	\$87, 135
White (%), Mexican/Latino (%)	49.7, 29.53	48.69, 36.51
Median Age (years)	25.7	35.61
Bachelor's Degree or Above (%)	56.29	36.56
Owner Occupied (%)	6.32	70.3
Household Size	2.53	3.31

CONCLUSION

This report details the goals, sampling design, and content of the fourth Phoenix Area Social Survey, conducted in 2017. With the overall aim of increasing knowledge about human-environment interactions in the context of the urban ecosystem of Metropolitan Phoenix, Arizona, the survey – focused on sampling residents throughout the region – addresses several issues including:

- perceived quality of life and satisfaction with environmental attributes in diverse neighborhoods across the region
- personal identification with the desert and geographical areas ranging from local neighborhoods to the region as a whole (i.e., the Valley of the Sun)
- perceptions and attitudes about birds and other wildlife as well as a variety of ecosystem services and disservices
- perceptions of various environmental risks including heat stress and flooding, along with household practices associated with their migration
- landscaping choices, yard-management practices, and changes made to housing and parcels that affect assorted social and environmental outcomes
- broad-based environmental and political values, length of residency, and other social and demographic variables

The 2017 survey design targeted residents in twelve case study neighborhoods that are profiled herein. Co-located with other research conducted as a part of CAP LTER, these neighborhoods were purposively chosen to represent diverse locations and demographics across the greater Metropolitan Phoenix area. Although the sample does not represent a random, representative sample of residents in the study region, the neighborhoods and their residents do characterize a wide range of regional attributes including low- to high-income households as well as geographic spread across central city locations and areas along the urban fringe. Relative to regional demographics, the surveyed neighborhoods over-represent areas of higher socioeconomic status as well as those with larger portions of minorities, especially those from Mexico and other Latino countries.

With an overall response rate of 39%, the final sample includes 497 respondents across the twelve neighborhoods. This includes a range of 22 to 60 respondents in each neighborhood. The individuals surveyed were, on average, 51 years old with household incomes in the \$80,000-\$100,000 range. The sample is predominantly women (61%) and highly educated (29% have bachelor's degrees and 26.5% have graduate degrees). While about two-thirds of respondents identified as white, 21% were of Mexican or Latino descent.

We anticipate that some research incorporating the PASS IV data will use the entire sample, while other research will focus on particular neighborhoods. Similarly, some researchers will focus on the social science dynamics inherent in only the PASS dataset, while others will link the social survey data to ecological or other physical datasets. Collectively, the research conducted with the PASS data will enhance knowledge about how people interact with the urban environment and infrastructure with implications for urban ecosystems, human well-being, and regional sustainability.

WORKS CITED

- Belaire, J.A., L.M. Westphal, C.J. Whelan, and E.S. Minor. 2015. Urban residents' perceptions of birds in the neighborhood: Biodiversity, cultural ecosystem services, and disservices. *The Condor* 117(2), 192-202.
- Brown, G., D. Pullar, and V.H. Hausner. 2016. An empirical evaluation of spatial value transfer methods for identifying cultural ecosystem services. *Ecological Indicators* 69: 1-11.
- Clergies, P., G. Mennechez, A. Sauvage, and A. Lemoine. 2001. Human perception and appreciation of birds: a motivation for wildlife conservation in urban environments of France. In *Avian Ecology and Conservation in an Urbanizing World*, 69-88. Springer US.
- Clucas, B., J.M. Marzluff, S. Kübler, and P. Meffert. 2011. New directions in urban avian ecology: reciprocal connections between birds and humans in cities. In *Perspectives in Urban Ecology*, 167-195. Springer Berlin Heidelberg.
- Cox, D. T. and K.J. Gaston. 2015. Likeability of garden birds: Importance of species knowledge and richness in connecting people to nature. *PloS One* 10(11): e0141505.
- Diener, E.D., R.A. Emmons, R.J. Larsen, & S. Griffin. 1985. The satisfaction with life scale. *Journal of Personality Assessment* 49(1): 71-75.
- Dunlap, R.E., K.D. Van Liere, A.G. Mertig, and R.E. Jones. 2000. New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of Social Issues* 56 (3): 425-442.
- Harlan, S.L., A.J. Brazel, L. Prashad, W.L. Stefanov, and L. Larsen. 2006. Neighborhood microclimates and vulnerability to heat stress. *Social Science and Medicine* 63 (11): 2847-2863. doi:10.1016/j.socscimed.2006.07.030.
- Jenerette, G.D., S.L. Harlan, A. Buyantuev, W.L. Stefanov, J. Deplet-Barreto, B.L. Ruddell, S.W. Myint, S. Kaplan, and X. Li. 2016. Micro-scale urban surface temperatures are related to land-cover features and residential heat-related health impacts in Phoenix, AZ USA. *Landscape Ecology* 31 (4): 745-760. doi:10.1007/s10980-015-0284-3.
- Larsen, L., S.L. Harlan, B. Bolin, E.J. Hackett, D. Hope, A. Kirby, Amy Nelson, T.R. Rex, and S. Wolf. 2004. Bonding and bridging: Understanding the relationship between social capital and civic action. *Journal of Planning Education and Research* 24(1): 64-77.
- Larson, K.L. 2010. An integrated theoretical approach to understanding the sociocultural basis of multidimensional environmental attitudes. *Society and Natural Resources* 23(9): 898-907.
- Larson, K.L., D. Casagrande, S. Harlan, and S. Yabiku. 2009. Residents' yard choices and rationales in a desert city: social priorities, ecological impacts, and decision tradeoffs. *Environmental Management* 44: 921-937
- Larson, K.L., E. Cook, C. Strawhacker, and S. Hall. 2010. The influence of diverse values, ecological structure, and geographic context on residents' multifaceted landscaping decisions. *Human Ecology* 38(6): 747-761.
- Larson, K.L., J. Hoffmann, and J. Ripplinger. 2017. Legacy effect and landscape choices in a desert. *Landscape and Urban Planning* 165: 22-29. <http://dx.doi.org/10.1016/j.landurbplan.2017.04.01>

- Larson, K.L., K. Nelson, S. Samples, S. Hall, N. Bettez, J. Cavender-Bares, P. Groffman, M. Grove, J. Heffernan, S. Hobbie, J. Learned, J.L. Morse, C. Neill, L. Ogden, J. O'Neil-Dunne, D. Pataki, C. Polsky, R. Roy Chowdhury, M. Steele, and T.L.E. Trammell. 2016. Ecosystem services in managing residential landscapes: Value priorities, dimensions, and cross-regional patterns. *Urban Ecosystems* 19(1): 95-113. DOI 10.1007/s11252-015-0477-1
- Lerman, S.B. and P.S. Warren. 2011. The conservation value of residential yards: linking birds and people. *Ecological Applications* 21(4), 1327-1339.
- Lerman, S.B., P.S. Warren, R. Burnette, H.L. Bateman and K.L. Larson. 2016. Tracking urban bird community change within a socioecological framework. VI North American Ornithological Conference, August 16-19, 2016, Washington, DC. Talk.
- Ruddell, D.M., S.L. Harlan, S. Grossman-Clarke, and A. Buyantuyev. 2009. Risk and exposure to extreme heat in microclimates of Phoenix, AZ. In *Geospatial Techniques in Urban Hazard and Disaster Analysis*, 179–202. Geotechnologies and the Environment. Springer, Dordrecht. doi:10.1007/978-90-481-2238-7_9.
- Ruddell, D., S.L. Harlan, S. Grossman-Clarke, and G. Chowell. 2012. Scales of perception: Public awareness of regional and neighborhood climates. *Climatic Change* 111 (3–4): 581–607. doi:10.1007/s10584-011-0165-y.
- Sallis, J.F. 2017. Neighborhood Quality of Life Survey. University of California, San Diego. http://sallis.ucsd.edu/measure_nqls.html. Last accessed 2017 July 26.
- The WHOQOL Group. 1998. The World Health Organization Quality of Life Assessment (WHOQOL). Development and psychometric properties. *Social Science and Medicine* 46:1569-1585.
- Warren, P. S., S. B. Lerman, R. Andrade, K. Larson, and H. Bateman. In progress. The more things change, the more they stay the same: Species losses detected in Phoenix over a five-year period despite stability in bird-socioeconomic relationships.
- Williams, D.R. and J.J. Vaske. 2003. The measurement of place attachment: Validity and generalizability of a psychometric approach. *Forest Science* 49(6): 830-840.